

Utah Department of Transportation



2002 Standard Specifications FOR ROAD AND BRIDGE CONSTRUCTION

U.S. Standard Units (Inch-Pound Units)

Change Four

June 2, 2003

Memorandum

UTAH DEPARTMENT OF TRANSPORTATION

DATE: June 2, 2003

TO: Holders of Hard Copy of Standard Specifications

FROM: Barry Axelrod, CDT
Standards and Specifications

SUBJECT: Standard Specifications Distribution, Change 4, dated June 2, 2003

A new Index and updated Standard Specifications are attached. Please take the following action with respect to the attached pages. When done post this page in front of your book.

REMOVE

Index Of Standard Specifications
Listing of Revised Standard Specifications
00555 (dtd July 3, 2002)
01280 (dtd July 3, 2002)
01282 (dtd July 3, 2002)
02222 (dtd February 27, 2003)
02231 (dtd July 3, 2002)
02705 (dtd July 3, 2002)
02741 (dtd February 27, 2003)
02752 (dtd July 3, 2002)
02753 (dtd July 3, 2002)
02747 (dtd July 3, 2002)
02842 (dtd July 3, 2002)
02861 (dtd December 19, 2002)
02911 (dtd July 3, 2002)
02931 (dtd July 3, 2002)
03392 (dtd July 3, 2002)
03921 (dtd July 3, 2002)
03922 (dtd July 3, 2002)
03923 (dtd July 3, 2002)
03924 (dtd July 3, 2002)
03935 (dtd July 3, 2002)
07105 (dtd July 3, 2002)
13553 (dtd July 3, 2002)
13554 (dtd July 3, 2002)

INSERT

Index Of Standard Specifications
Listing of Revised Standard Specifications
00555 (dtd April 24, 2003) (Revised)
01280 (dtd April 24, 2003) (Revised)
01282 (dtd April 24, 2003) (Revised)
02222 (dtd April 24, 2003) (Revised)
02231 (dtd April 24, 2003) (Revised)
02705 (dtd April 24, 2003) (Revised)
02741 (dtd April 24, 2003) (Revised)
02752 (dtd April 24, 2003) (Revised)
02753 (dtd April 24, 2003) (Revised)
None - Section deleted
02842 (dtd April 24, 2003) (Revised)
02861 (dtd April 24, 2003) (Revised)
02911 (dtd April 24, 2003) (Revised)
02931 (dtd April 24, 2003) (Revised)
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03924 (dtd April 24, 2003) (Revised)
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07105 (dtd April 24, 2003) (Revised)
13553 (dtd April 24, 2003) (Revised)
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If you are in need of electronic copies of any of the Standard Specifications please refer to the Standards and Specifications Web page on the Internet or the Shared Data drive (for UDOT employees with access). The web address is <http://www.dot.utah.gov/esd/esdmenu3.htm>. From there select the **2002 Standards** link.

A copy of the Standard Specifications in Adobe pdf format can be found at <http://www.udot.utah.gov/esd/2002Standards/Specs/PDFFiles/UDOT2002Specs.pdf>. This file will remain static for the remainder of 2003. Changes to the Standards will be posted separately.

If you have any questions or problems with the electronic files contact me at (801) 964-4570 or by email at **baxelrod@utah.gov**.

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Listing of Revised Standard Specifications

Change One

Revised August 29, 2002

- Section 00570 Articles 1.2 A 69, A 71 b (deleted)
- Section 00727 Articles 1.1 D; 1.5 B; 1.9; 1.10; 1.16 B, C; 1.18 B
- Section 01574 Articles 1.2 B
- Section 02721 Articles 1.2 D (added), H (replaced), I (deleted); 1.6 B1; 2.1 A Table 3; 3.2 C
- Section 02741 Articles 3.8 E 2 a, b
- Section 2821 Articles 3.1 A
- Section 02892 Articles 1.5 A, B
- Section 02936 Articles 1.4; 1.5 C
- Section 03152 Articles 1.2 P, Q; 2.2 A, B
- Section 05120 Articles 1.4 A (deleted), 3.3 A
- Section 16525 Articles 1.6 A, B

Change Two

Revised December 19, 2002

- Section 01561 Article 3.1 A
- Section 02075 Article 2.7 A
- Section 02372 Article 2.1 A 4
- Section 02455 Article 3.3 B 2
- Section 02785 Article 3.2 C
- Section 02861 Article 3.3 A
- Section 03055 Articles 1.2 P (inserted), 2.3 B, 2.4 (deleted), 2.7 A 1 a-e (added), 2.7 B 2 (added), 2.8 A 1 a, 2.8 A 2 (deleted), 2.9 A3, 3.2 A Table, 3.2 C, 3.7 A 3, 3.8 C 1, 3.9 A-B, 3.10, 3.11 B 1, 3.11 B 3
- Section 07922 Article 2.1 Table 1

Change Three

Revised February 27, 2003

Section 01355 Article 1.3 A 3

Section 01721 1.4 C deleted and moved to Measurement and Payment document

Section 02222 Changed title from Site Demolition-Pavement to Site Demolition - Concrete, A, 3.2 Title, 3.2 A

Section 02224 New Specification

Section 02316 1.2 A, D, I added, 1.3 added, 1.7 B, C, D, E, F, G added, 3.9 A added

Section 02455 3.3 B 2 (corrected error from change two)

Section 02721 1.2 Related Sections added, 1.3 H and I added, 1.7 B, 1.7 F deleted, 2.1 B added, 2.2 deleted, 3.1 Title changed, 3.2 B reference added, 3.2 E added

Section 02741 1.4 C6a added, 1.4 H, Table 3, 2.4 A, 2.4 C, Table 9, 2.5 B 1-3, 2.5 B 4 added, 2.5 D, 3.1 A1 deleted, 3.2 C3 added, 3.7 D1, 3.9 B4, 3.9 B5 added, 3.9 E note added

Section 02744 Entire Section deleted

Section 02745 1.4 A9

Section 02785 1.2 C and D added

Section 02892 Added Articles, 1.3 N, O, Y, 1.5 D, 2.4 I, 2.5 C, D, E, 2.6 B3 - B6, 2.6 C, 2.16, 2.17, 3.11 and Revised Articles 3.5 F and Table Number, 3.5 G and Table Number

Section 02896 2.1 A, B and 3.1 A drawing number corrected

Section 16525 1.2 H

Change Four

Revised April 24, 2003

Section 00555 1.18 added Table 1

Section 01280 1.2 K

Section 01282 1.13 B added, 1.13 G 2 deleted

Section 02222 1.2 B Title Changed

Section 02231 3.5 A

Section 02705 Title Changed, 1.1 A, 1.3 added, 3.1 Title changed, 3.1 A, 3.1 D moved, 3.2 added

Section 02741 3.7 B

Section 02747 Entire Section deleted

Section 02752 1.8 E 1

Section 02753 3.1 D 5 a, 3.3 D

Section 02842 2.4A

Section 02861 2.1 I

Section 02911 3.2 A 1

Section 02931 3.2 B

Section 03392 2.1 A 8-9

Section 03921 2.1 A 1, 2.1 C

Section 03922 2.1 B 1-2

Section 03923 2.1 A-B, 3.1 B

Section 03924 2.2 A-B

Section 03935 2.1 A, 2.1 A 2

Section 07105 2.3 A

Section 13553 1.2 C Title Changed

Section 13554 1.1 A, 1.3 C and D added, 2.1 A, 2.1 F, 2.2 D 1, 2.2 D 2 deleted, 2.2 E,
2.2 H, 2.2 H 2, 2.2 H 3 deleted and renumbered, 3.1 B 3 added, 3.1 I

SECTION 00555

PROSECUTION AND PROGRESS

PART 1 GENERAL

1.1 RELATED SECTIONS

- A. Section 00570: Definitions.
- B. Section 00727: Control of Work.
- C. Section 01282: Payment.
- D. Section 01355: Environmental Protection.

1.2 PRECONSTRUCTION CONFERENCE

- A. Engineer schedules and conducts at the earliest date following award and execution of the contract.
- B. Purpose is to permit a general and open discussion between the Department, Contractor, utility, railroad, and other invited parties.
- C. Topics of discussion could include:
 - 1. Partnering
 - 2. Contract plan and specification requirements
 - 3. Contractor's plan, schedule, and stages for completing work
 - 4. Utility and railroad companies plan of alteration
 - 5. Coordination between utilities and railroads
 - 6. Stages for completing work
 - 7. Anticipated traffic problems and traffic handling procedures
 - 8. External equal employment opportunity specifications
 - 9. Field office and laboratory requirements
 - 10. Project safety
 - 11. Wage rates, etc.

- D. Topics to receive special attention and emphasis:
 - 1. Environmental commitments
 - 2. Permit requirements
 - 3. Erosion control measures
 - 4. Maintenance of Traffic
- E. Contractor supplied items:
 - 1. List of Suppliers
 - 2. List of Subcontractors
 - 3. Accident Prevention Plan
 - 4. Erosion Control Plan
- F. Before Contractor begins work on the project:
 - 1. Traffic Control Plan
 - 2. 511 information
- G. Before Work Begins on Item:
 - 1. Subcontract (if item is subcontracted)
 - 2. Certificates of Compliance
- H. Before first estimate
 - 1. CPM Schedule
 - 2. C400, Schedule of Payments
 - 3. Certified Payrolls (Federal Aid Projects Only)

1.3 NOTICE TO PROCEED

- A. Proceed with the work after receipt of written notice from the Department.
- B. Notify the Engineer at least 5 calendar days before beginning work.
- C. Contract time begins 10 calendar days after the date of the Notice to Proceed.
- D. Contract Time Option (when included in the proposal):
 - 1. Include a completed "Contract Time Option Form" stipulating the date for beginning contract time. Stipulate a beginning date within the construction season and not later than the date established on the form.
 - 2. Contract time is on a working day basis under this Section, articles, "Determining Contract Time," and "Extending Contract Time."
 - 3. Contract time charges begin on the date selected, and the original number of allowable working days remains in effect.

4. To change the submitted Contract Time Option, request in writing a minimum of 15 calendar days before the submitted Contract Time Option begin date. Obtain written approval from the Department before deviating.

1.4 SUBLETTING CONTRACT

- A. Obtain written approval of the Department before subletting, selling, transferring, assigning or disposing any portion of the Contract or Contracts.
- B. Sublet no more than 50 percent of the total contract work bid amount.
- C. Subcontracts whether committed to in writing or by an informal, unwritten arrangement or transfer of the Contract, or any part of it or its obligations, do not relieve liability under the Contract and bonds. As part of its contract with the Department, the Contractor accepts liability for any claims for damages or liability resulting from an act or omission of any person who carried out work on its behalf, whether that working relationship is codified into a subcontract or carried out by an informal, unwritten agreement. The Contractor agrees to indemnify the Department for any damages or liability, including attorney's fees and court costs, that may be incurred by such a person.
- D. Do not allow subcontract work to begin until approved by Engineer.
- E. In computing the percentage of subcontracted work, Department considers an item as subcontracted in its entirety unless otherwise designated in the subcontract.
 1. Department uses the accumulated percentages of all approved subcontracts to assure that the maximum subcontracted limitation is not exceeded.
 2. To determine the amount of work subcontracted, the Department uses the total dollar amount of the items subcontracted, as specified in the Contract Bid Proposal, divided by the original contract amount less "specialty items."
 3. If the prime Contractor is to perform a portion of an item, the Department determines the amount of work subcontracted by using the dollar amount of the item agreed to between the prime Contractor and the subcontractor, excluding bonds, insurance, profit, and office transaction, etc. performed by the Contractor.
- F. Provide for a reduction in retained monies commensurate with the percentage held as retainage as provided for in Section 01282, article, "Progress Payments."

- G. Include a statement agreeing on a method of distribution of any adjustments due to price increases or decreases using applicable price adjustment specifications for fuel, cement, common carrier rates, etc.

1.5 PROGRESS SCHEDULES

- A. Submit a progress schedule as the basis for establishing critical construction operations and monitoring project progress.
- B. Use the form specified in this Section, article, "Critical Path Method Schedule Prepared by the Contractor," unless otherwise specified.
- C. Prepare the Anticipated Monthly Payment Schedule using the dates and accomplishment shown on the Critical Path Method (CPM) Baseline schedule.
- D. Prepare the Monthly Payment Schedule:
 - 1. Submit the proposed Monthly Payment Schedule before the date established for the first partial payment.
 - 2. Use form provided at the Preconstruction Conference.
 - 3. Include both monthly and semi-monthly payments when anticipated due to the volume of work on the project.
 - 4. Include all months during the life of the contract when payments are anticipated.
 - 5. Support and coordinate schedule with the CPM Baseline Schedule.
 - 6. Include dates of contract start, suspension, completion and milestones that impact payments.
- E. Submit Revised Payment Schedule within 30 days of notification by the Engineer. Payment Schedule Revisions are required when:
 - 1. Actual Payments vary 10 percent or more (plus or minus) from the submitted Payment Schedule and the variance is sustained for 60 days.
 - 2. Contract start, suspension, completion and milestones dates change.
 - 3. Change Orders are approved increasing or reducing the contract amount sufficient to vary actual payments 10 percent or more (plus or minus) from the accepted Payment Schedule.

1.6 CRITICAL PATH METHOD SCHEDULE PREPARED BY THE CONTRACTOR

- A. Required for all contracts unless otherwise specified in special provision.

- B. Plan and record project construction with conventional Critical Path Method (CPM) schedule.
 - 1. Use CPM for coordinating and monitoring all work under the Contract including all activities of subcontractors, vendors, and suppliers.
- C. The Department uses the schedule to:
 - 1. Monitor the progress of construction.
 - 2. Compare the work performed to the contract time and phasing requirements.
 - 3. Assign necessary resources for inspection and administration of the Contract.

1.7 CRITICAL PATH - INTERIM BASELINE SCHEDULE

- A. Submit an interim baseline schedule to the Engineer at or before the pre-construction meeting describing the activities occurring during the first 60 days of the project.
- B. Provide two prints and one 3-1/2 inch diskette compatible with Primavera Project Planner or Suretrak Project Manager or in a form that can be restored into Primavera without requiring a conversion program.
- C. Provide:
 - 1. Detail plan of work in accordance with the Contract time and phasing requirements specified in the Contract.
 - 2. Sequence of early operations, submittals, working drawings and procurement of materials.
 - 3. Describe the activities to be accomplished and their interdependencies.
 - 4. Assign a responsibility code to each activity corresponding to the subcontractor or trade responsible for performing the work.
 - 5. Assign a phase code to each activity corresponding to the location of sub-parts or phases of the work.
- D. Derive all data supporting time extension requests from the Baseline CPM Schedule. Do not use the Interim Baseline Schedule for time extension analysis.
- E. Engineer reviews the Interim Baseline Schedule and gives comments within seven calendar days of receipt.
- F. Use the Interim Baseline Schedule and the Engineer's comments to prepare the Baseline CPM Schedule.

- G. After receiving Notice to Proceed, proceed with work described in the 60-day preliminary schedule that does not conflict with the contract time and progress requirements.

1.8 CRITICAL PATH - BASELINE CPM SCHEDULE

- A. Submit a Baseline CPM Schedule for approval on or before the date established for the first partial payment.
- B. Provide two prints and one 3 ½” diskette compatible with Primavera Project Planner or Suretrak Project Manager or in a form that can be restored into Primavera without requiring a conversion program.
- C. Include in the Baseline CPM Schedule:
1. Critical Path using all allotted contract time. Submit a Resource loaded schedule if proposing an early completion date.
 2. Complete logical plan for executing the work. Establish relationships or dependencies between all activities.
 - a. Activities must represent the detailed project scope of work.
 - b. Show actual workdays estimated to perform each activity including consideration of weather impacts and seasonal limitations.
 - c. Tie each activity to Contract Bid Items with coding in the Baseline CPM Schedule.
 - d. Describe work activities so that each item is easily identified. For each activity:
 - Assign a Responsibility code and Phase code
 - Identify the trade or entity performing the work
 - Identify the proposed number of work days
 - Identify manpower involved by trade and work location
 3. Include Calendar(s) used to develop CPM schedule (description of workdays per week, hours per shift, shifts per day)
 4. Designate the scheduled “Data Date” as the day prior to the first working day of the contract.
- D. The Engineer reviews the schedule within seven calendar days of receipt and, if needed, arranges for a job site meeting with the Contractor for discussion of the schedule.
1. Failure to provide a baseline schedule may result in withholding all Contract payments until an acceptable schedule is received.
 2. Review of the schedule does not bind the Department or constitute acceptance of any individual time period for scheduled activities.

1.9 CRITICAL PATH - SCHEDULE UPDATES

- A. Engineer and Contractor hold monthly job site progress meetings to update the Baseline CPM schedule. They review progress to verify actual start and finish dates of completed activities, remaining duration of uncompleted activities, and the sequence of activities.
 - 1. Submit the following:
 - a. A bar chart grouped by PHASE listing all activities, early/late and actual start and finish dates, remaining durations, percent complete and Total Float.
 - b. A pure logic or PERT diagram on standard, individual D-size sheets (24 inches X 36 inches).
 - c. A narrative report with progress analysis. Include a description of problem areas, current and anticipated delaying factors and impact, if necessary. Explain corrective actions taken and proposed recovery plan, if requested by the Engineer.
 - d. A backup of the schedule on 3 ½" computer diskette.

1.10 CRITICAL PATH - SCHEDULE REVISIONS

- A. Either Contractor or Department may request revisions to the accepted Baseline CPM Schedule. Do not revise Baseline CPM Schedule without the Engineer's prior written approval.
- B. A revised baseline schedule is considered necessary under the following conditions.
 - 1. The Engineer determines there is reasonable doubt that milestones or the Contract completion date will not be met.
 - 2. There is a significant change in the Contractor's operations that will affect the critical path.
 - 3. Actual prosecution of the work differs from that represented on the latest schedule update.
 - 4. There are additions, deletions, or revisions to activities required by Contract modification.
- C. The Engineer reviews the revised baseline schedule within seven calendar days of receipt. If the Engineer rejects the revised baseline schedule, submit again within seven calendar days. When approved, the revised Baseline Schedule becomes the basis for the next submitted schedule update.

1.11 CRITICAL PATH - REQUIREMENTS

- A. Failure to provide schedule updates or a revised baseline schedule may result in withholding all subsequent Contract payments until an acceptable schedule is received.
- B. As determined by CPM analysis, only Department-caused delays in activities affecting milestone dates or contract completion dates are considered for a time extension.
- C. When requesting a time extension of any milestone or contract completion date, furnish documentation to enable the Engineer to determine whether a time extension is appropriate under the terms of the Contract.
- D. Adjust contract completion time under this Section, articles, "Determining Contract Time," and "Extending Contract Time."
- E. Float time in the schedule is a shared commodity between the Department and the Contractor.

1.12 LIMITATION OF OPERATIONS

- A. Minimize traffic interference:
 - 1. Conduct the work to minimize interference with traffic.
 - 2. Finish a section of roadway if it is essential to public convenience before starting work on any additional sections as specified in the Contract.
- B. Sundays or holidays: Perform no work without written approval except repair or servicing of equipment, protection of work, maintenance or curing of concrete, or maintenance of traffic.
- C. Night work:
 - 1. Give five calendar days notice before starting night work.
 - 2. Provide adequate lighting for performing satisfactory inspection and construction operations.
 - 3. Control noise and vibration under the provisions of Section 01355, article, "Noise and Vibration Control."

1.13 CHARACTER OF WORKERS

- A. Provide sufficient resources to complete all work of the Contract and employ workers with the skill and experience necessary to perform the work.

- B. Remove any person employed who performs the work in an improper or unskilled manner, or who is intemperate or disorderly. Rehire these employees only with the Engineer's written permission.
- C. Failure to remove any employee(s) or to furnish suitable and sufficient personnel to perform the work may result in a written notice to suspend the work.

1.14 METHODS AND EQUIPMENT

- A. Use equipment of the size and mechanical condition to perform and produce the specified work.
- B. Do not damage the roadway, adjacent property, or other highways.
- C. Use of methods or equipment other than those specified only with the Engineer's written permission.
 - 1. Describe in writing the proposed methods and equipment to be used and the reasons for the change.
 - 2. Once approval is received, produce work meeting project requirements.
 - 3. Discontinue use of alternate methods or equipment if the Engineer determines that the work does not meet contract requirements.
 - 4. Remove and replace or repair deficient work to return it to specified quality at no cost to the Department.
 - 5. Department does not change the basis of payment for a change in methods or equipment.

1.15 DETERMINING CONTRACT TIME

- A. The Bid Documents and Contract state the "Contract Time," which is days allowed for completing the Contract.
 - 1. The Engineer furnishes a monthly statement showing the number of days charged to the Contract for the preceding month and the number of days remaining for completion of the Contract.
 - 2. The statement is considered correct and accepted unless a written protest is submitted to the Engineer before the next monthly statement, documenting the reasons the monthly statement is considered incorrect.
 - 3. Immediately review and resolve any dispute with the Engineer.
- B. Determining Contract Time
 - 1. Working Day: Determined Contract time on a working day basis under Section 00570, article, "Terms," line, "Working Day."

2. Calendar Day: Determined Contract time on a calendar day basis under Section 00570, article, "Terms," line, "Calendar Day."
 - a. Department excludes Calendar days elapsing between the effective dates of any orders of the Engineer to suspend and resume work that are not the fault of the Contractor.
 - b. Weather is not considered an authorized suspension.
3. Completion Date: Calendar completion date is the date the Engineer completes final acceptance under Section 00727, article, "Project Acceptance - Final." The Department does not consider time extensions:
 - a. If the Notice to Proceed is made within 30 calendar days after the opening of Bid Proposals.
 - b. If the Notice to Proceed is delayed due to the Contractor's failure to submit required information or return the signed Contract.
4. Terminating Contract Time Charges: Daily time charge ceases when substantial completion is accepted following Section 00570, article, "Terms," line, "Substantial Completion."
5. Time charges resume if items covered by "Substantial Completion" or work identified during final inspection are not completed within an agreed period of time or at the discretion of the Engineer.

1.16 EXTENDING CONTRACT TIME

- A. Overruns: Department increases contract time commensurate with the amount of added work as determined by the final estimate.
- B. Extra Work: Additional contract time may be included on approved change orders. Added time covered by change order is excluded from the Overtime computation on the final estimate.
 1. Request in writing to add "Contract Time" due to extra work. Include in a "Change Order" covering the proposed extra work if approved by the Engineer.
 2. Time added to calendar day and completion date contracts is in calendar days.
 3. Time added to working day contracts is in working days.
- C. Partial Suspension: Suspension of work on some items as ordered by the Engineer is considered a partial suspension.
 1. Applicable only to working day or calendar day contracts.
 2. Engineer determines the time charged for each day on partial suspensions not the fault of the Contractor as the greater of:
 - a. 0.15 day

- b. The quotient (rounded to hundredths) obtained by dividing the sum of the bid amount for the specific items of work not suspended by the total value of original contract amount.
- D. Request for Time Extension:
 - 1. Request time extension in writing before the expiration of the contract time. Provide justification for the extension.
 - 2. Extensions may be justified for delays beyond the control and fault of the Contractor including delivery of critical materials caused by national emergency, strikes, embargoes, area-wide shortages, or abnormal reasons.
 - 3. Extensions are not justified for the following:
 - a. Delay in material delivery due to financial considerations, delayed placement of orders, or other conditions within the Contractor's control.
 - b. Insufficient contract time or work suspension for non-compliance with the contract requirements.

1.17 INCENTIVE/DISINCENTIVE

- A. The Contract includes an incentive/disincentive provision detailing applicable dates and work stages covered by the provision if the Department determines that it is in the public's interest to complete the project at the earliest possible date.
- B. Department increases or decreases payment by the amount established for each calendar or working day the project or phase is open to unrestricted continuous traffic as specified in the Contract.
- C. Engineer determines unrestricted continuous traffic under Section 00570, article, "Terms," "Unrestricted Continuous Traffic."
- D. Relating to liquidated damages, this Section, "Failure to Complete on Time," remains in effect and is applicable to the total contract time.
- E. Department pays the earned amount of incentive in the progress payment, and deducts the amount of disincentive from progress payments.
- F. Reimburse the Department within 30 calendar days of notice that payment is due for the difference should the amount of disincentive or liquidated damages exceed the amount due for completed work.
- G. The Engineer grants no time extension:
 - 1. For delays in material deliveries unless it can be shown that such delays are industry wide.
 - 2. For quantity overruns, or adverse weather conditions.

1.18 FAILURE TO COMPLETE ON TIME

- A. Department deducts from any money due the sum specified in the following Schedule of Liquidated Damages (Table 1) for each calendar day or working day that any work remains uncompleted after the specified contract time or approved extension has elapsed. See Section 00570, article, "Terms," "Liquidated Damages."

Table 1
Schedule of Liquidated Damages

Original Contract Amount		Daily Charge	
From more than	To and including	Calendar Day Fixed Date	Work Day
\$0	\$100,000	\$210	\$830
100,000	500,000	450	950
500,000	1,000,000	680	1380
1,000,000	5,000,000	1270	2170
5,000,000	10,000,000	1860	2950
10,000,000	30,000,000	2770	4930
30,000,000		4100	8240

- B. Allowing the continuation and completion of the work after the specified contract completion time or approved extension has elapsed does not waive the Department's rights under the Contract.
- C. Time charges may be suspended on working day or calendar day contract after the Department determines that the Contract is substantially complete under Section 00570, article, "Terms," line, "Substantial Completion."
1. Assessment of liquidated damages continues until all contract work is completed for a specified calendar completion date contract.
 2. Contractor is not entitled to any reduction beyond the administrative review process in Section 00727, article, "Procedures for Resolutions of Disputes," and article, "Procedures for Resolution of Claims."

1.19 TERMINATION FOR DEFAULT

- A. Termination can occur if the Contractor:
1. Fails to begin the work under the Contract within the time specified.
 2. Fails to perform the work with sufficient resources to assure the prompt completion of the work.

3. Fails to perform the work in accordance with the Contract requirements or neglects or refuses to remove and replace rejected materials or unacceptable work.
 4. Discontinues the prosecution of the work.
 5. Fails to resume work within the time specified upon notification from the Department.
 6. Becomes insolvent, or is declared bankrupt, or commits any act of insolvency or bankruptcy.
 7. Allows any final judgment to remain unsatisfied for a period of 10 calendar days.
 8. Makes an assignment for the benefit of creditors without the Department's approval.
 9. Fails to comply with Contract requirements including minimum wage payments or EEO requirements.
 10. Is a party to fraud.
- B. The Engineer may declare the Contract in default by written notice to the Contractor and the Surety advising them of the actions required for remedy.
- C. Comply with the written notice within 10 calendar days of receipt or the Department has full power and authority to terminate the Contract.
- D. The Department may appropriate or use any or all materials and equipment at the project site and enter into another contract for completion of the work according to the terms and provisions thereof, or use such methods as determined by the Department to complete the Contract.
- E. All costs and charges incurred by the Department, including the cost of completing the work under the Contract, are deducted from monies owed or that may be owed the Contractor. Should the expense exceed the sum that would have been payable under the Contract, the Contractor and Surety are liable and must pay the Department the amount of the excess.

1.20 TERMINATION OF CONTRACT FOR CONVENIENCE OF THE DEPARTMENT

- A. The Department may by written order terminate the Contract or any portion thereof after determining that for reasons beyond the Contractor's or the Department's control, the Contractor is prevented from proceeding with or completing the work and that termination would be in the public interest.
- B. Reasons for termination may include, but are not limited to:
 - 1. Executive Orders of the President relating to prosecution of war or national defense.
 - 2. National emergency that creates a serious shortage of materials.
 - 3. Orders from duly constituted authorities relating to energy conservation.
 - 4. Restraining Orders or Injunctions obtained by third-party citizen action resulting from national or local environmental protection laws or where the issuance of such order or injunction is primarily caused by acts or omissions of persons or agencies other than the Contractor.
- C. When the Department orders termination of a Contract effective on a certain date, the Department pays for all completed items of work as of that date at the Contract bid price.
 - 1. Department pays for partially completed work either at agreed prices or by force account methods.
 - 2. Department pays for items that are eliminated in their entirety as provided in Subsection 01282, article, "Eliminated Items."
- D. Materials obtained by the Contractor that have not been incorporated into the project may be:
 - 1. Purchased from the Contractor at the option of the Department at actual cost delivered to a prescribed location.
 - 2. Disposed of as mutually agreed.
- E. Contractor may submit a claim for additional costs not covered in the Contract after receipt of Notice of Termination from the Department.
 - 1. Submit within 60 calendar days of the effective termination date.
 - 2. Include cost items such as:
 - Reasonable idle equipment time
 - Mobilization efforts
 - Bidding and project investigative costs
 - Overhead expenses attributable to the project terminated
 - Reasonable profit on work completed
 - Subcontractor costs not otherwise paid for

- Actual idle labor cost if work is stopped in advance of termination date
 - Guaranteed payments for private land usage as part of original Contract
 - Any other direct cost the Contractor has incurred
- 3. The negotiated settlement figure reached with the Contractor does not include loss of anticipated profits.
- F. Make cost records available to the Department for determining the validity and amount of each item claimed, and for providing a basis for negotiating an equitable settlement.
- G. Termination of a Contract or portion thereof does not relieve the Contractor of contractual responsibilities for the work completed, nor does it relieve the Surety of its obligation for and concerning any just claim arising out of the work performed.

1.21 SAFETY REQUIREMENTS

- A. Adhere to the requirements and responsibilities of the UDOT Construction Safety and Health Manual. Obtain a copy from the Department.
- B. Allow access to all areas of work on the project, upon presentation of credentials to the Contractor for any inspector or officer of Utah OSHA, UDOT Risk Management, or other legally responsible agency involved in safety or health administration without delay and without presentation of an inspection warrant.
- C. Immediately correct any conditions that do not comply with the foregoing provisions.
 - 1. The Engineer issues a stop work order when either site conditions and/or work practices present an imminent danger (i.e. may result in serious injury, death or extensive property damage) until those conditions and/or practices are corrected.
 - a. A stop work order does not provide relief from completing the project within the specified contract completion time.
 - 2. The Engineer will issue a start work order when satisfactory corrective action is taken.

PART 2 PRODUCTS Not used

PART 3 EXECUTION Not used

END OF SECTION

Change One - August 29, 2002
No changes made

Change Two - December 19, 2002
No changes made

Change Three – February 27, 2003
No changes made

Change Four – April 24, 2003
Articles Revised
1.18 Table 1

SECTION 01280

MEASUREMENT

PART 1 GENERAL

1.1 DEFINITIONS

- A. Station: 100 feet.
- B. Ton: 2,000 pounds avoirdupois.

1.2 GENERAL MEASUREMENT OF QUANTITIES

- A. All work completed under the Contract is measured in U. S. Standard measure.
- B. The methods of measurement and computations for determining quantities of material furnished and of work performed under the Contract are methods generally recognized as conforming to good engineering practice.
- C. When the estimated quantities for a specific portion of the work are designated to be the pay quantities for the Contract:
 - 1. They are the final quantities for which payment for such specific portion of the work will be made, unless the plan dimensions are revised by the Engineer.
 - 2. If revised dimensions result in an increase or decrease in the quantities of work, Department will revise the final quantities for payment in the amount represented by the authorized changes in the dimensions.
- D. Measurements for area computations:
 - 1. Longitudinal measurements: made horizontally.
 - 2. Transverse measurements: the neat dimensions shown on the plans.
- E. Computing volumes of excavation: Average end area method, or computer generated Digital Terrain Model (DTM) method, unless the Engineer and Contractor agree in writing to an alternate method.
- F. Measure complete structure or structural unit, signal or lighting system, ("lump sum" work) unit to include all necessary fittings and accessories.
- G. Structures: Neat lines shown on the plans or as altered to fit field conditions.

- H. Standard manufactured items (fence, wire, plates, rolled shapes, pipe conduit, etc.), are identified by gauge, unit, weight, section dimensions, etc.
 - 1. Identification will be nominal weights or dimensions.
 - 2. Use industry manufacturing tolerances, unless more stringently controlled by specifications.
- I. Items measured by the foot, (pipe culverts, guardrail, underdrains, etc.): measure parallel with the base or foundations upon which structures are placed.
- J. The thickness of plates and galvanized sheet used in the manufacture of corrugated metal pipe, metal plate pipe culverts and arches, and metal cribbing: measured in fractions of inches.
- K. Measure in final position materials measured by volume.
- L. Materials specified to be measured by the cubic yard may be weighed and converted to cubic yard for payment purposes, when requested by the Contractor and approved by the Engineer in writing. Engineer determines and Contractor agrees to the factors for conversion from weight measurement to volume before this method of measurement of pay quantities is used.
- M. Rental of equipment: measure hours of actual working time and necessary traveling time of the equipment within the limits of the project.
 - 1. If the Engineer orders special equipment in connection with force account work, the Department measures travel time and transportation to the project.
 - 2. If the Engineer orders equipment held on the project on a standby basis, the Department pays the agreed rental rate minus the operating cost.

1.3 MEASUREMENT OF QUANTITIES - MATERIALS

- A. Asphalt materials: gallon or ton.
 - 1. Department measures volumes at 60 degrees F or corrects to the volume at 60 degrees F using ASTM D 1250 for asphalts or ASTM D 633 for tars.
 - 2. Department uses net certified scale weights or weights based on certified volumes in the case of rail shipments as a basis of measurement, subject to correction when asphalt material has been lost from the car or the distributor, wasted, or otherwise not incorporated in the work.
 - 3. When asphalt materials are shipped by truck or transport, net certified weights or volume subject to correction for loss or foaming may be used for computing quantities.
- B. Cement: ton

1.4 WEIGHING REQUIREMENTS AND PROCEDURES

- A. Weigh all materials that are measured or proportioned by weight, or contract items measured by the ton, such as aggregates and asphalt materials, on scales that have been approved, certified, and which meet specification requirements.
- B. If material is shipped by rail, the car weight may be accepted provided only the actual weight of material will be paid for.
 - 1. Car weights are not acceptable for material processed through mixing plants.
 - 2. Weigh trucks used to haul material empty daily at times as directed by the Engineer, and place on each truck a legible identification mark.
- C. An inspector observes materials delivered to the project or designated site.
 - 1. Submit the printed or written haul ticket to Inspector.
 - 2. At this time, the Inspector can accept materials, and initial and retain the ticket.
 - 3. Department may return any loads of material that appear to be deficient or questionable to be reweighed.

1.5 SCALES

- A. Have the Utah State Department of Agriculture, Division of Weights and Measures inspect and seal all scales inspected and sealed at least once a year, and before use each time the scale is moved or adjusted.
- B. Scale accuracy: to within 0.5 percent of the maximum load required.
- C. Furnish, erect, have certified, and maintain, or use permanently installed and certified commercial scales for weighing highway and bridge construction materials that are required to be proportioned or measured and paid for by weight:
 - 1. Scales must be accurate within the limits set by the laws of the State of Utah, meeting requirements of the U.S. Bureau of Standards.
 - 2. Scales must bear a current seal of acceptance from the State of Utah Department of Agriculture, Division of Weights and Measures.
- D. Physically arrange electronic, beam, dials, platform, and other scale equipment for convenient and safe viewing.
- E. Cease using scales that overweigh (indicate more than true weight). Reduce all materials received subsequent to the last previous correct weighing accuracy test by the percentage of error in excess of one half of 1 percent.

- F. Adjust scales that underweigh (indicating less than true weight). Department will allow no additional payment to the Contractor for materials previously weighed and recorded.
- G. Include in the unit contract prices for the various pay items of the Contract, costs for furnishing, installing, certifying or testing, and maintaining scales, furnishing scale house, materials for proportioning or payment, and all other items specified in this section for the weighing of highway and bridge construction materials

1.6 PLATFORM SCALES

- A. Install and maintain a level platform with rigid bulkheads at each end.
- B. Must be of adequate size and capacity so the entire power unit and hauling unit can be weighed at the same time.
 - 1. The Contractor may use a platform scale that will accommodate the power unit and the first hauling unit and all remaining hauling units in two weighing operations.
 - 2. When using two weighing operations, provide a level approach at both ends of the scale at least 75 feet in length composed of a base course and a minimum of 3 inches of Hot Mix Asphalt or 3 inches of concrete cement pavement.
 - 3. Repair or replace approach grades, or any portion that varies by more than one-tenth of one percent, or revert to weighing the entire power unit and hauling units at the same time.
- C. Contractor is responsible for costs for constructing and maintaining the approaches.

1.7 ELECTRONIC HOPPER SCALE REQUIREMENTS

- A. The Contractor has the option of furnishing an electronic hopper scale system. When this type of weighing system is used, the following applies:
 - 1. Use hopper or load cells.
 - 2. Weights must be accurate to 1.0 percent of true weights.
 - 3. Provide an automatic printer that will provide the following information:
 - a. Project number and name
 - b. Date
 - c. Time
 - d. Ticket number
 - e. Haul unit number
 - f. Gross weight (if possible)
 - g. Tare weight
 - h. Net pounds or tons
 - i. A minimum of two copies of each ticket

j. Description of item

- B. Maintain electronic and hopper scales and conduct necessary testing to assure continued scale accuracy within specification limits after certification by the Department of Agriculture and required by specification.
- C. Comparison Test: The accuracy of the hopper scale may be checked by comparing the weight of the material from the hopper and the weight of the material after it is weighed on another certified scale. Comparisons within 0.5 percent tolerance or within the combined tolerance of the two scales are acceptable.
- D. If no platform scales are readily available, use known weights to occasionally recalibrate the scales by hanging weights from the weigh hopper.
- E. Furnish weights equal to 12.5 percent of capacity and of known accuracy. Use a buildup procedure in combination with the weights by batching or placing a measured amount of material in the hopper and adding known weights to verify.
- F. Request written approval to use alternate weighing devices.

1.8 DEPARTMENT INSPECTION AND VALIDATION OF WEIGHTS

- A. Continuously Observed Weighing Method to validate weights:
 - 1. The Department provides a scale person who must either weigh, or observe, or weigh and observe the weighing of equipment or trucks both loaded and empty to determine the payload of materials to be hauled.
 - 2. The scale person issues a weigh ticket at the scale site when truck scales without automatic printers are provided by the Contractor.
- B. Random Scale Weighing Check Method to validate weights:
 - 1. Use when a Department scale person does not weigh materials, or when an electronic scale with an automatic printer is used for weighing equipment, trucks, or materials.
 - 2. The Engineer validates the equipment, truck, and material weight by random reweighing or by other methods as indicated.
- C. Engineer or Inspector randomly checks the weight of the equipment, trucks, and the material indicated on the electronically produced weigh ticket or manually prepared ticket, by reweighing the loaded truck on another certified scale, if available.
 - 1. If no other platform scales are available, Engineer may check by operating the scale in the manual mode.
 - 2. When manual verification is used, Engineer reweighs the truck by running it back over the platform scale to manually check weights.

- D. Conduct frequent checks at the beginning of the operations to verify proper scale function and accuracy.
 - 1. Frequency may be reduced after initial verification to a minimum of once per week when a substantial amount of material is being weighted.
 - 2. Scale Tests: Maintain scales and conduct necessary testing to verify scale accuracy within the specifications.
 - a. When the scale does not meet specified tolerance, discontinue using the scale until it is operating within specifications.
 - b. Comparison scale checks must be within a 0.5 percent tolerance of the net load or within the combined tolerance of the two scales or two weights.

1.9 PROJECTS WITH SMALL QUANTITIES

- A. Engineer may accept and receive small quantities of materials paid by weight when the following conditions are met.
 - 1. The vendor, producer, or supplier issues a signed weight ticket to the truck driver, weighted on certified scales.
 - 2. A Department employee or inspector receives the certified weigh ticket at the site, and notes visual acceptance on the ticket for the quantity and other required information.
 - 3. The amount of material received on the project for any one day does not exceed:
 - a. Hot Mix Asphalt or Open Graded Surface Course - 100 tons
 - b. Untreated Base Course - 200 tons
 - c. Borrow or Granular Borrow - 300 tons

PART 2 PRODUCTS Not used.

PART 3 EXECUTION Not used.

END OF SECTION

Change One - August 29, 2002
No changes made

Change Two - December 19, 2002
No changes made

Change Three - February 27, 2003
No changes made

Change Four - April 24, 2003
Revised Article
1.2 K

SECTION 01282

PAYMENT

PART 1 GENERAL

1.1 RELATED SECTIONS

- A. Section 00555: Prosecution and Progress.
- B. Section 00725: Scope of Work.
- C. Section 00727: Control of Work.
- D. Section 01280: Measurement.

1.2 SCOPE OF PAYMENT

- A. Department fully compensates Contractor as provided in the Contract for:
 - 1. Furnishing all materials, labor, equipment, tools, transportation and incidentals required for completion of the work.
 - 2. All loss or damage due to the nature of the work, action of the elements and unforeseen difficulties until final acceptance by the Department, subject to the provisions of Section 00725, article, "Contractor's Responsibility for Work."
 - 3. All costs arising from any infringement of a patent, trademark, or copyright.
- B. Lump sum: Complete payment for the work described in the Contract when used as an item of payment.
- C. Department will not pay Contractor for:
 - 1. Work that is in excess of that contained in the Contract.
 - 2. Removal and replacement of defective work.
 - 3. Loss of anticipated profits.
- D. Neither partial payment nor release of retainage relieves the Contractor of the obligation to correct all defective work or materials.

1.3 ALTERED QUANTITIES

- A. When the accepted quantities of work vary from the estimated quantities in the Contract, the Department pays the original contract unit prices for the accepted quantities of work done.
 - 1. Department does not allow for any increased expenses, loss of expected reimbursement, or loss of anticipated profits suffered or claimed by the Contractor resulting either directly from such alterations or indirectly from unbalanced allocation among the contract items of overhead expense and subsequent loss of expected reimbursement or from any other cause.
 - 2. Exceptions: as provided in
 - a. Section 00555, article, "Termination of Contract for Convenience of the Department."
 - b. Section 00725, article, "Differing Site Conditions."
 - e. Section 00725, article, "Significant Changes in the Character of the Work."
 - d. Section 00725, article, "Suspensions of Work Ordered by the Engineer."

1.4 DIFFERING SITE CONDITIONS, CHANGES, EXTRA WORK

- A. Department pays for differing site conditions, changes, and extra work performed under Section 00725 at unit price or lump sum as stipulated in the order authorizing the work.
- B. The Contractor's representative and the Engineer compare independent cost estimates to determine the cost of extra work.
- C. At the Engineer's request, provide a cost analysis for the extra work detailed as follows:
 - 1. Labor classifications, total hours for each classification, wage rate, and extension for each classification.
 - 2. Cost of fringe benefits and subsistence.
 - 3. Quantities of materials, prices, and extensions.
 - 4. Equipment classifications, total hours, rental rate, and extension for each unit of machinery and equipment.
 - 5. Transportation of materials and equipment.
 - 6. If applicable, subcontractors' cost analysis.

1.5 FORCE ACCOUNT WORK - GENERAL

- A. Instead of a unit price or lump sum basis specified above, the Department may require the Contractor to do such work on a force account basis.
- B. Department does not make additional allowance for:
 - 1. Timekeepers, bookkeepers, or other general office help.
 - 2. General superintendent except for the time spent in direct supervision of the force account work.
 - 3. The use of small tools (tools costing \$400 or less) or other costs for which no specific allowance is herein provided.
- C. Department does not pay for pickup trucks used solely for transportation.
- D. Department pays straight time for all hours worked. Overtime must have the prior written approval of the Engineer.

1.6 FORCE ACCOUNT WORK - LABOR

- A. Compensation for labor: Department pays for all labor, including direct supervision, used in the actual and direct performance of the work, at the rate of wage (or scale) agreed upon in writing before beginning work.
- B. Department reimburses for actual costs paid to, or in behalf of workmen, including subsistence and travel allowances, and health and welfare required by collective bargaining agreements or other employment contract generally applicable to the classes of labor employed on the work.
 - 1. Department pays to Contractor an amount equal to 60 percent of the sum of the above items to cover the costs of bonds, insurance, taxes, etc.
 - 2. Contractor's wage, payroll, and cost records pertaining to work paid for on a force account basis is open to inspection or audit.

1.7 FORCE ACCOUNT WORK - MATERIALS

- A. Department pays for all materials accepted by the Engineer and incorporated in the project at actual cost:
 - 1. Including sales taxes and transportation charges plus 15 percent.
 - 2. Excluding machinery rentals as hereinafter set forth.
- B. Include invoices with statements for all materials used. Certify by affidavit the cost of material furnished from Contractor's stocks when no invoice is available.

1.8 FORCE ACCOUNT WORK - CONTRACTOR OWNED EQUIPMENT

- A. Department pays for machinery or special equipment, excluding small tools, authorized by the Engineer at an hourly rate obtained from the "*Rental Rate Blue Book For Construction Equipment*," (Blue Book). These hourly rental rates are determined by the monthly rental rate taken from the above-mentioned publication divided by 176. Updated supplements are authorized for use Statewide on specified dates. Obtain this publication through:

Equipment Watch
1735 Technology Drive, Suite 410
San Jose, CA 95110-1313
Phone: (800) 669-3282
Fax: (408) 467-6795
www.equipmentwatch.com

- B. The total hourly rates derived from the above have been computed from equipment costs currently in effect. The rates derived do not include costs for operating personnel.
- C. The rates require adjustment by a Regional Factor and a Depreciation Factor found in the front of each Chapter in the Rental Rate Blue Book.
- D. Equipment Rental rates can fall in the following two categories:
1. Operating Rate - For those hours the equipment is actually in use. Includes ownership and operating costs. Adjusted for depreciation using Rate Adjustment Table and region using the Regional Adjustment Maps.
 2. Standby Rate - Compensation for equipment required to be at the work site but not operating. Includes ownership costs only. This rate is 50 percent of the adjusted ownership costs computed in the previous article. The duration of allowable standby time is to be approved in writing by the Engineer with a maximum of 8 hours per day or 40 hours in a normal week.
- E. When the "Manufacturer's Rated Capacity" falls between those shown in this manual, the Department uses the shown capacity which is closest to the manufacturer's. Do not interpolate for rates in between.
- F. Agree upon all rates in writing before work is begun and measured as provided in Section 01280.
- G. Equipment rental rates not provided by the aforementioned manual must be approved by the Office of Construction and Materials before the start of any "force account work."

- H. Department allows “move-in” and “move-out” transportation cost for a piece of equipment not available on the job, if the particular piece of equipment is not moved onto the job under its own power.
 - 1. Department allows hourly operating rate for equipment moved to the site under its own power.
 - 2. Department pays these charges only once for any particular piece of equipment except in unusual circumstances that must be justified in writing and agreed to by the Engineer.

1.9 FORCE ACCOUNT WORK - RENTED OR LEASED EQUIPMENT

- A. When the equipment to be used is specialized in nature and is not available in the Contractor's inventory and is rented or leased from an outside source, Department adds a 10 percent allowance on the first \$5,000 plus five percent of the balance in excess of \$5,000 for overhead for all rented or leased equipment paid for by invoices.
 - 1. Where the rental rate charged exceeds the rate determined by the Blue Book, submit the rental or lease agreement to the Engineer for Construction and Materials for approval.
 - 2. Department pays equipment operating costs at the rate from the Blue Book for rented or leased equipment for each hour the equipment was actually used.
- B. When the required equipment is in the Contractor's available inventory but not on the project site, the equipment may be rented from a local source. The Engineer may approve rental rates for equipment obtained from local sources when such rates are within 10 percent of the Blue Book. When the equipment is to be used less than a week, “move-in” and “move-out” costs for Contractor owned equipment may be considered when comparing rental costs of equipment obtained from local sources.
 - 1. This option is only allowed when the cost of locally rented equipment would be less than using Contractor owned equipment including “move-in” and “move-out” charges.
 - 2. Such rentals must be supported by a cost analysis indicating the method used was the least expensive.
 - 3. If the Contractor elects to rent equipment of a type that is in the Contractor's inventory and the rental costs exceed that allowed by this article, the Department reimburses for such equipment based on the Blue Book.

1.10 FORCE ACCOUNT WORK - SUBCONTRACTS

- A. For all force account work performed under an approved subcontract, Department pays an additional allowance equal to ten percent of the first \$5,000 plus 5 percent of the balance in excess of \$5,000 for overhead for the subcontract.
- B. The Engineer reviews each situation to determine that performing the work by subcontract is justified.

1.11 FORCE ACCOUNT WORK - STATEMENTS

- A. The Contractor's representative and the Engineer compare records of the cost of work done as ordered on a force account basis.
- B. At the Engineer's request, provide an itemized statement of the cost of the force account work detailed as follows:
 - 1. Name, classification, date, daily hours designating straight time and overtime, total hours, rate, and extension for each laborer and supervisor. (Payrolls may be used for part of this information.)
 - 2. Designation, dates, daily hours, total hours, rental rate, and extension for each unit of machinery and equipment.
 - 3. Quantities of materials, prices, and extensions.
 - 4. Transportation of materials and equipment.
 - 5. Cost of fringe benefits and subsistence.
 - 6. Subcontractors.

1.12 ELIMINATED ITEMS

- A. If the Department determines items contained in the Contract are unnecessary, the Engineer eliminates the items from the Contract with a Change Order to the Contractor. This action does not invalidate the Contract.
- B. When a Contractor is notified of eliminated items, Department reimburses for actual work done under the provisions of Section 01282, article, "Differing Site Conditions, Changes, Extra Work;" and articles concerning Force Account Work (General, Labor, Materials, Contractor-Owned Equipment, Rented or Leased Equipment, Subcontracts, Compensation).

1.13 PROGRESS PAYMENTS

- A. Department makes progress payments at least once each month as the work is progressing.

- B. More frequent payments may be made during any period when the Department determines that the value of work performed during the period is of sufficient amount to warrant a payment.
- C. Payments are based on estimates prepared by the Engineer of the value of the work performed and materials in place under the Contract and for materials delivered under this Section, article, "Payment for Material on Hand."
- D. Department makes no progress payment when the total value of the work done since the last estimate is less than \$1,000.
- E. From the total of the payable amounts, the Department deducts and retains 5 percent until after the entire Contract has been completed in an acceptable manner. When no less than 95 percent of the work has been completed, and with the consent of the Surety, the Engineer may prepare a semi-final estimate from which the Department retains 1-1/2 percent of the original contract amount. The Department certifies the remainder for payment, less all previous payments.
- F. The Contractor may enter into an addendum agreement providing for the payment of retained monies into an escrow account, or the Department does so automatically.
 - 1. These monies are to be applied toward the purchase of approved securities that are to be held by an escrow agent until satisfactory completion of the construction Contract.
 - 2. The value of the securities placed in escrow has a minimum value equal to or greater than the amount that would otherwise be retained.
 - 3. The addendum agreement must be executed concurrently with the execution of the construction Contract. Agreement forms are available in the office of the Department's Engineer for Construction and Materials.
- G. The Department pays the Contractor within 14 calendar days after certification and approval of billings and estimates.
 - 1. Contractor and Engineer agree to a Saturday partial estimate closing date. Succeeding partial estimates close on the same Saturday for each succeeding month.
 - 2. Contractor approves partial estimate prior to submission.

1.14 PAYMENT FOR MATERIAL ON HAND

- A. When the Contractor presents delivery copies of invoices, the Department may include in the partial payment invoice, advance payments for acceptable nonperishable materials purchased expressly to be incorporated into the work when delivered in the vicinity of the project, or stored in approved storage place.
 - 1. The Engineer determines the amount to be included in the estimate, but in no case will the amount exceed the value of the materials as shown on the delivery invoice, or 75 percent of the in-place price, whichever is less.
 - 2. When the approved storage location is other than the project site, furnish evidence that the stockpiled materials are irrevocably obligated to the project.
 - 3. Department does not pay when the invoice value of such materials, as determined by the Engineer, amounts to less than \$2,000 or if materials are to be stored less than 30 calendar days.
 - 4. Within 60 calendar days following the date of the estimate invoice on which the stockpile material is to be paid by the Department, furnish to the Engineer certified paid invoices or a certified statement with a copy of the check showing payment.
 - 5. Material will be removed from the next partial estimate as stockpiled materials if proper invoices showing payment to the supplier is not received.
- B. Department makes no partial payment on living or perishable materials until incorporated as specified in the Contract.
- C. Department does not pay for materials brought onto the site at the Contractor's election that may be incorporated into the project such as fuels, supplies, metal decking forms, ties, or supplies used to improve efficiency of operations.
- D. Approval of partial payment for stockpiled materials does not constitute final acceptance of such materials for use in completing items of work.
- E. Department purchases at actual cost and without any percentage allowance for profit, materials delivered to the project in compliance with the Contract or left unused due to changes in plans or variation in quantities, if the materials are not practicably returnable for credit.
 - 1. Purchased materials become the property of the Department.
 - 2. Actual costs are based on invoice price plus transportation costs to the work.
- F. Payment is limited to contract quantities unless ordered by the Engineer. Assume responsibility for excess materials delivered to the project, or aggregate produced beyond the contract amount without authority from the Engineer.

- G. At the option of the Department, surplus aggregates up to the contract quantities may be purchased provided:
 - 1. The material is stockpiled where directed, and
 - 2. The material meets specification requirements when stockpiled.
- H. Department pays for material accepted on an agreed price basis, which price is normally the Contractor's production cost. In addition, the Department pays the cost to haul the materials to the stockpile site and place in pile at the rate of 9 cents per ton mile or 20 cents per cubic yard mile.

1.15 ACCEPTANCE AND FINAL PAYMENT

- A. When the project has been accepted as provided in Section 00727, articles, "Project Acceptance - Partial," and "Project Acceptance - Final," the Engineer prepares the final estimate of work performed.
 - 1. If the Contractor approves the final estimate or does not object to the quantities within 30 calendar days of receiving the final estimate, the Department processes the estimate for final payment.
 - 2. After approval of the final estimate by the Contractor, Department pays for the entire sum due after deducting all previous payments and all amounts to be retained or deducted under the provisions of the Contract.
- B. If additional payment is due from the Department, file with the Department a full, complete, and itemized written statement justifying the adjustment within 30 calendar days after the final estimate is submitted for approval.
 - 1. All disputes not itemized in said statement are waived by the Contractor.
 - 2. Submission of disputes by the Contractor will not be reason for withholding full payment of the total value of work shown on the Engineer's final estimate.
 - 3. The Department evaluates the dispute. If it is determined that additional payment is due, the final estimate is revised accordingly, under the terms of the Contract. If not, the estimate as submitted is final.
- C. All prior partial estimates and payments are subject to correction in the final estimate and payment.
- D. The Department has the final estimate complete and to the Contractor within six months of when the Contractor meets substantial completion of the project and has supplied the Engineer with all project certifications.

1.16 ADJUSTMENTS FOR FUEL COST

- A. This price adjustment provision is intended to minimize risk to the Contractor due to potential volatile price fluctuations for fuel that might occur throughout the duration of the Contract.
 - 1. The Contractor may invoke this provision at any time during the Contract by written notification to the Engineer.
 - 2. Adjustments are then made on all prior and future partial estimates. When this provision becomes effective, it remains in effect for the duration of the Contract.
- B. This provision is not designed to estimate actual quantities of fuel used in construction operations, but to provide a reasonable basis for calculating a fuel price adjustment based on average conditions.
- C. Department determines compensation adjustments under the provisions of this Section, and presumes that the Contractor has relied on these provisions for compensation adjustments when determining unit bid prices.
- D. Terms for calculating adjustments for fuel costs:
 - 1. Fuel Partial Estimate Base Price (EP): - The average of all base prices determined during the partial estimate period.
 - a. The Department determines the base price per barrel for crude on the first working day of each week, using postings from the commodities and futures section of the Wall Street Journal for West Texas Intermediate (WTI) crude using the spot price for that date as a basis.
 - b. A conversion factor of 42 gallons per barrel is used.
 - 2. Fuel Contract Base Price (CP): The base price determined for the week during which the bid opening is held. The source of the price is the same as that used for the (EP).
 - 3. Fuel Usage Factors (FU): A combined diesel and gasoline factor. Table 1 contains the items for which adjustments may be made, and the fuel usage factors upon which the adjustment is based.
- E. Determining Adjustments (AF): The Engineer computes the adjustments separately for each partial estimate period. The adjustment is determined based on appropriate items in Table 1 using the formula with the following constraints.
 - 1. The Partial Estimate Base Price must change plus or minus 15 percent from the Contract Base Price before an adjustment is made; then add or deduct 5 percent per the formula.

2. Engineer adjusts only major contract items as defined by Section 00570, article, "Terms," paragraph, "Major and Minor Contract Items," or items that have an individual value of \$100,000 or more based on original contract quantities.
 3. Adjustments in compensation may be either plus or minus depending on the differences between the Contract Base Price and the Partial Estimate Base Price.
- F. Work Beyond Contract Time: Adjustment will not apply to any work performed after the expiration of contract time plus approved time extensions.
- G. Upward Ceiling: If the Partial Estimate Base Price increases by more than 50 percent from the Contract Base Price for an adjustable bid item, the Department determines whether it is feasible for the remainder of the project to proceed, and notifies the Contractor in writing if the project is to be terminated.
- H. Adjustment Formula:

EP greater than CP:

$$AF = \frac{[(EP - CP) - 0.05 CP] Q (FU)}{42}$$

EP less than CP:

$$AF = \frac{[(EP - CP) + 0.05 CP] Q (FU)}{42}$$

Where:

EP	=	Partial Estimate Base Price per barrel (dollars)
CP	=	Contract Base Price per barrel (dollars)
Q	=	Quantity of Acceptable Work Performed on Item
FU	=	Fuel Usage Factor for that Item
AF	=	Adjustment for Fuel Costs in Dollars
42	=	Gallons per Barrel of Crude

Table 1
Adjustable Items and Fuel Usage Factors

Item of Work	Quantity of Work (Q)	Combined Diesel & Gasoline Usage Factor (FU)
Roadway Excavation, Borrow, Embankment, Granular Borrow, Top Soil	Cubic Yard Ton	0.45 0.25
Loose Riprap	Cubic Yard	0.57
Underdrain Granular Backfill	Cubic Yard	1.16
Untreated Base Course	Ton	0.84
Hot Mix Asphalt	Ton	3.60
Open-Graded Surface Course	Cubic Yard Ton	7.20 3.60
Cover Material: Produced and Placed on Roadway	Ton	0.64
Produced and Stockpiled	Ton	0.36
Portland Cement Concrete Pavement	1 inch thick	0.214
Lean Concrete Base Course	Sq Yard	0.048
Structures (includes: Concrete, Piles, Reinforcing Steel, Structural Steel) Pipe Culvert Special Pipe Culvert (includes excavation for structures) Underdrains Right-of-Way Fence & Gates Seeding Concrete Small Structures Portland Cement Concrete Highway Traffic Paint Precast Concrete Barrier Guardrail	\$	0.038 Gal

1.17 ADJUSTMENT FOR ASPHALT MATERIALS

- A. This price adjustment provision is intended to minimize risk to the Contractor due to potential volatile price fluctuations for asphalt materials that might occur throughout the duration of the Contract.
 - 1. The Contractor may invoke this provision at any time during the Contract by written notice to the Engineer.
 - 2. Department then adjusts future partial estimates. When this provision becomes effective it remains in effect for the duration of the Contract.
- B. Department adjusts the price of asphalt materials for work done on bid items that contain asphalt materials, including asphalt cement, liquid asphalt, and emulsified asphalt.
- C. Department determines compensation adjustments under the provisions of this Section, and presumes that the Contractor has relied on these provisions for compensation adjustments when determining unit bid prices.
- D. Terms for calculating adjustments for asphalt materials are as follows:
 - 1. Asphalt Partial Estimate Base Price (EP): The average of all the base prices determined during the partial estimate period.
 - a. On the first working day of each week, the Department determines the base price per barrel for crude oil using postings from the commodities and futures section of the Wall Street Journal for West Texas Sour (WTS).
 - b. A conversion factor of 5.6 barrels per ton is used.
 - 2. Asphalt Contract Base Price (CP) - The base price determined for the week during which the bid opening is held is the Contract Base Price. The source of the price is the same as that used for the (EP).
- E. Determining Adjustments (AF): The Engineer computes the adjustments separately for each partial estimate period. The adjustment on each item is determined using the formula with the following constraints.
 - 1. The Partial Estimate Base Price of asphalt materials must change plus or minus 15 percent from the Contract Base Price before an adjustment is made; then add or deduct 5 percent per the formula.
 - 2. Adjustments in compensation may be either plus or minus depending on the differences between the Contract Base Price and the Partial Estimate Base Price.
- F. Work Beyond Contract Time: Adjustment will not apply to any work performed after the expiration of contract time plus approved time extensions.

G. Upward Ceiling: If the Partial Estimate Base Price increases by more than 50 percent from the Contract Base Price for an adjustable bid item, the Department determines the feasibility for proceeding with the remainder of the project and notifies the Contractor in writing if the project is to be terminated.

H. Adjustment Formula
EP greater than CP:
 $AF = [(EP - CP) - 0.05 CP] (5.6) Q$
EP less than CP:
 $AF = [(EP - CP) + 0.05 CP] (5.6) Q$

Where:

EP = Partial Estimate Base Price per barrel (dollars)
CP = Contract Base Price per barrel (dollars)
Q = Quantity in ton of Asphalt Materials used
AF = Adjustment for Asphalt Costs in dollars
5.6 = Barrels per ton of Asphalt

The Engineer calculates the tons of asphalt product that will be Q in the above equation for the following:

HMA (Hot Mix Asphalt)
Open-Graded Surface Course
Emulsified Asphalts
Cutback Asphalts

PART 2 PRODUCTS Not used.

PART 3 EXECUTION Not used.

END OF SECTION

Change One - August 29, 2002

No changes made

Change Two - December 19, 2002

No changes made

Change Three – February 27, 2003

No changes made

Change Four – April 24, 2003

Articles Revised

1.13 B added

1.13 G 2 deleted

SECTION 02222

SITE DEMOLITION - CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Demolish, remove, and dispose of concrete pavement, curb, gutter, sidewalk, concrete driveway approach, waterway, and similar hard surfaces.

1.2 RELATED SECTIONS

- A. Section 00727: Control of Work.
- B. Section 02705: Pavement Cutting.

PART 2 PRODUCTS Not used.

PART 3 EXECUTION

3.1 PREPARATION

- A. Review all work procedures with Engineer.
- B. Coordinate utility location in accordance with Section 00727, article, "Cooperation With Utilities."
- C. Preserve all active utilities.
- D. Detours according to traffic control plan.

3.2 CONCRETE PAVEMENT REMOVAL

- A. Saw cut existing pavement on the designated with straight vertical edges free from irregularities when joining new construction to existing pavement. Refer to Section 02705.
- B. Completely remove pavement down to the underlying base course or subgrade.

3.3 OBLITERATION

- A. Break up concrete into pieces not over 1 ft² in area. Scarify and cover broken concrete with at least 1 ft of suitable backfill material.
- B. Fill depressions and blend with the surrounding contours.
- C. Grade materials either along the toe of an embankment or into a depression or borrow pit. Cover with at least 1 ft of suitable backfill material.

3.4 CONCRETE SIDEWALK, CONCRETE DRIVEWAY REMOVAL

- A. Remove concrete to the nearest expansion joint or saw cut to provide proper grades and connections.
- B. Make concrete cuts straight, vertical to the surface, full depth, and free from irregularities. Refer to Section 02705.
- C. Thoroughly clean all adhering materials from existing reinforcement.
- D. Do not damage concrete designated to remain.

3.5 CONCRETE CURB, CONCRETE CURB AND GUTTER, RAISED ISLAND, BITUMINOUS CURB REMOVAL

- A. Remove curb, curb and gutter, gutters, raised island, bituminous curb, and parts of such improvements to an existing joint or joint sawed with a vertical face.
- B. Remove material to provide proper grades and connections.

END OF SECTION

Change One – August 29, 2002

No changes made

Change Two – December 19, 2002

No changes made

Change Three – February 27, 2003

Revised articles

Changed title from Site Demolition-Pavement to Site Demolition - Concrete

1.1 A

3.2 Title

3.2 A

Change Four - April 24, 2003

Revised Articles

1.2B Title Changed

SECTION 02231

SITE CLEARING AND GRUBBING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Clear, grub, remove and dispose of trees, stumps, and debris within the staked limits of the roadways, channels, easements, and other designated areas.

1.2 DEFINITIONS

- A. Clear: remove and dispose of trees, stumps, logs, limbs, sticks, vegetation, debris, and other material on the natural ground surface.
- B. Grub: remove and dispose of roots, buried logs, debris, and other material under the ground surface.

1.3 RELATED SECTIONS

- A. Section 01355: Environmental Protection.
- B. Section 01571: Temporary Environmental Controls.
- C. Section 02221: Remove Structure and Obstruction.

PART 2 PRODUCTS Not used.

PART 3 EXECUTION

3.1 PREPARATION

- A. Verify with Engineer which vegetation or objects are to be removed.

- B. Review work procedures with Engineer.
- C. Schedule work carefully with consideration for property owners and general public.
- D. Follow Section 01571 for temporary environmental measures.

3.2 VEGETATION REMOVAL

- A. Grub the areas 2 feet below natural ground within the limits of clearing of all stumps, roots, buried logs, and all other underground obstructions.
- B. Stumps, roots, and non-perishable solid objects may remain in cleared areas where the embankment is
 - 1. 2.0 feet or more above the natural ground.
 - 2. At least 2.0 feet away outside the slope stake lines.
- C. Completely grub stumps and roots where a structure is to be constructed, piles are to be driven, or unsuitable material is to be removed.

3.3 BACKFILLING

- A. Backfill all stump holes, cuts, depressions, and other holes resulting from clearing and grubbing within areas to receive embankment. Compact backfilled areas to the density of the surrounding ground.

3.4 DISPOSAL

- A. Dispose of material following Section 01355.
- B. Do not dispose of material within the designated roadbed.
- C. Do not end dump material over the side of the embankment.
- D. Off the right-of-way:
 - 1. Acceptable when done according to prevailing laws (including environmental laws), ordinances, regulations, and rules, and at no additional cost to the Department.
 - 2. Furnish the Engineer with copies of the disposal permits or agreements.

- E. On the right-of-way:
 - 1. Bury material at locations specified or acceptable to the Engineer.
 - 2. Use material to widen embankments and flatten embankment sides slopes as approved by the Engineer.
 - 3. Cover disposed material with a minimum of 2.0 feet of earth and grade to drain properly at no additional cost to the Department.
 - 4. Reduce wood to chips a maximum of 1/2 inch thick for mulching cut and fill slopes. Chips may be buried or distributed uniformly on the ground surface and mixed with the underlying earth so the mixtures will not sustain burning.

3.5 TREE REMOVAL

- A. Trees removed with a circumference up to 20 inches, measured at 2.0 feet above existing ground are considered incidental construction.
 - 1. A tree consists of stump, root, trunk, branches, and foliage.
 - 2. Department will not count multiple leaders rising from a common root separately.
- B. Remove the root system to a minimum depth of 2.0 feet below the finished ground level and within a 2.0 foot radius of the stump.
- C. For trees over 18.0 inches in circumference: Refer to Section 02221.

3.6 PROTECTION

- A. Land monuments, property markers, or official datum points:
 - 1. Protect until their removal is approved.
 - 2. Reference for re-establishment before removing.
- B. Protect trees from damage to roots and branches if they are designated to remain.
- C. Protect other vegetation and/or objects designated to remain.

END OF SECTION

Change One - August 29, 2002
No changes made

Change Two - December 19, 2002
No changes made

Change Three - February 27, 2003
No changes made

Change Four - April 24, 2003
Revised Article
3.5 A

SECTION 02705

PAVEMENT CUTTING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Saw or cut pavements, curb and gutter, sidewalk, and/or any appurtenances as required to provide a smooth surface to match.

1.2 RELATED SECTIONS

- A. Section 02748: Prime Coat/Tack Coat.

1.3 PAYMENT PROCEDURES

- A. Department makes no separate payment for Pavement Cutting. Include in associated bid items.

PART 2 PRODUCTS Not used

PART 3 EXECUTION

3.1 PROCEDURE – CONCRETE SURFACES

- A. Saw cut vertically in a straight line through the full depth of the surface.
- B. Where the edge of the existing surface is cracked, broken, or deteriorated, make the cut so the defective surface can be removed.
- C. Do not allow traffic or construction equipment to cross the cut edge.

3.2 PROCEDURE – ASPHALT SURFACES

- A. Use any method that provides a vertical cut in a straight line through the full depth of the surface.
 - 1. Should the method of cutting not produce a smooth, non-broken edge, saw cutting will be required at no additional cost to the Department.
- B. Where the edge of the existing surface is cracked, broken, or deteriorated, make the cut so the defective surface can be removed.
- C. Do not allow traffic or construction equipment to cross the cut edge.
- D. When appropriate, apply a tack coat to the cut edge before placing hot mix asphalt surfacing. Refer to Section 02748.

END OF SECTION

Change One - August 29, 2002

No changes made

Change Two - December 19, 2002

No changes made

Change Three - February 27, 2003

No changes made

Change Four - April 24, 2003

Revised Articles

Title Changed

1.1 A

1.3 added

3.1 Title changed

3.1 A

3.1 D moved

3.2 added

SECTION 02741

HOT MIX ASPHALT (HMA)

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Products and procedures for laying, and compacting a surface course of one or more layers of HMA comprised of aggregate, asphalt binder, lime and other additives.
- B. Mix materials at a central mixing plant.

1.2 RELATED SECTIONS

- A. Section 01452: Profilograph
- B. Section 02742S: Project Specific Surfacing Requirements
- C. Section 02745: Asphalt Material
- D. Section 02746: Hydrated Lime
- E. Section 02748: Prime Coat/Tack Coat
- F. Section 02969: Optional Use of Reclaimed Asphalt Pavement (PG Binder Projects Only)

1.3 REFERENCES

- A. AASHTO PP 28: Standard Practice for Superpave Volumetric Design for Hot-Mix Asphalt (HMA)
- B. AASHTO T 11: Materials Finer Than 75 Fm (No. 200) Sieve in Mineral Aggregates by Washing
- C. AASHTO T 19: Unit Weights and Voids in Aggregate
- D. AASHTO T 27: Sieve Analysis of Fine and Coarse Aggregates

- E. AASHTO T 30: Mechanical Analysis of Extracted Aggregate
- F. AASHTO T 89: Determining the Liquid Limit of Soils
- G. AASHTO T 90: Determining the Plastic Limit and Plasticity Index of Soils
- H. AASHTO T 96: Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine
- I. AASHTO T 104: Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
- J. AASHTO T 112: Clay Lumps and Friable Particles in Aggregate
- K. AASHTO T 166: Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated-Surface Dry Specimens
- L. AASHTO T 176: Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test
- M. AASHTO T 195: Determining Degree of Particle Coating of Bituminous-Aggregate Mixtures
- N. AASHTO T 209: Maximum Specific Gravity of Bituminous Paving Mixtures
- O. AASHTO T 255: Total Moisture Content of Aggregate by Drying
- P. AASHTO T 283: Resistance of Compacted Bituminous Mixture to Moisture Induced Damage (Modified by UDOT Materials Manual of Instruction Part 8 Test Procedure 8-957)
- Q. AASHTO T 304: Uncompacted Void Content of Fine Aggregate
- R. AASHTO T 308: Determining the Asphalt Binder Content of Hot-Mix Asphalt (HMA) by the Ignition Method
- S. AASHTO T 312: Method for Preparing and Determining the Density of Hot-Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor
- T. ASTM D 2950: Test Method for Density of Bituminous Concrete in Place by Nuclear Method
- U. ASTM D 3549: Thickness or Height of Compacted Bituminous Paving Mixture Specimens

- V. ASTM D 3665: Standard Practice for Random Sampling of Construction Materials
- W. ASTM D 3666: Specification for Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials
- X. ASTM D 4561: Practice for Quality Control Systems for Organizations Producing and Applying Bituminous Paving Materials
- Y. ASTM D 4791: Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
- Z. ASTM 5506: Practice for Organizations Engaged in the Certification of Personnel Testing and Inspecting Bituminous Paving Materials
- AA. ASTM D 5821: Determining the Percentage of Fractured Particles in Coarse Aggregate
- BB. ASTM E 178: Practice for Dealing with Outlying Observations
- CC. ASTM E 1274: Standard Test Method for Measuring Pavement Roughness Using a Profilograph
- DD. Asphalt Institute SP-1, SP-2
- EE. UDOT Materials Manual of Instruction Part 8-209: Asphalt Binder Management Plan
- FF. UDOT Materials Manual of Instruction Part 8-957: Resistance of Compacted Bituminous Mixture to Moisture Induced Damage
- GG. UDOT Materials Manual of Instruction Part 8-958: Standard Test Method for Determining Rutting Susceptibility
- HH. UDOT Materials Manual of Instruction Part 8-960: Guidelines for Superpave Volumetric Mix Design
- II. UDOT Materials Manual of Instruction Part 8-984: Sampling Methods

1.4 ACCEPTANCE

- A. A lot equals the number of tons of HMA placed during each production day. The Department will:
 - 1. Divide each lot into four sublots based on the scheduled production day.

2. Take random samples behind the paver before any further compaction, and determine random numbers/locations from a random numbers table. ASTM D 3665, UDOT Materials Manual of Instruction Part 8-984: Sampling Methods.
 - a. Take large enough samples for paired-T testing and split with contractor designated lab until testing discrepancies (based on tests outlined in article 3.9 "Dispute Resolution," paragraph B1, in addition to daily acceptance tests for mix properties) between labs are identified and resolved.
 3. Inform the Contractor of the time and place for the sample not more than 15 minutes prior to the sampling.
 4. Conduct the following tests:
 - a. Asphalt Binder Content: One per subplot using ignition oven. AASHTO T 308
 - b. Aggregate gradation: One test per subplot on the residue of the ignition oven tests. AASHTO T 30.
 - c. VMA: 3 tests per lot. AASHTO T 312
 5. Perform three Rice tests for each lot. Use the average for the lot to determine density of cores taken by the Contractor.
 6. Determine thickness of cores taken by the Contractor.
 7. Add the lot to the previous day's production if the minimum number of samples cannot be obtained for the final day's production and evaluate with the appropriate sample size.
 8. Add the lot to the next day's production if the minimum number of samples cannot be obtained, and evaluate with the appropriate sample size.
 9. Retest the lot if an individual test from a subplot is deemed an outlier based on ASTM E 178.
- B. The Engineer conducts the acceptance testing for asphalt binder content, gradation, VMA, density, and thickness. AASHTO T 30, T 308, PP 28, T 166, ASTM D 3549. For small projects with plan quantities of HMA less than 3000 tons or for work such as utility work, traffic signals, detours, lane leveling, etc., the Engineer may elect to accept material based upon visual inspection.
1. When acceptance is intended to be based upon visual inspection, the Engineer reserves the option of conducting any acceptance tests necessary to determine the material and workmanship meets the project requirements.
- C. Obtain samples for density and thickness.
1. Divide the lot into five sublots of approximately equal sizes.
 2. Obtain ten cores per lot randomly as instructed, and in the presence of the Engineer within two days after the pavement is placed.
 3. Comply with AASHTO T 166.

4. If the random location for cores falls within one foot of the edge of the overall pavement section (outer part of shoulders), then move transversely to a point one foot from the edge of the pavement.
 5. Fill core holes with an acceptable asphalt mixture and compact.
 6. The Department will take possession of the cores immediately, and will begin testing the cores within 24 hours for density acceptance.
 - a. Use Table 4 with $n=10$ to determine PWL for density.
- D. Density: The target density for determining acceptance and incentive/disincentive is 93.5 percent of maximum Rice density for projects where design overlay thickness is greater than 2 inches. For projects where design overlay thickness is 2 inches or less, target density for determining acceptance and incentive/disincentive is 92.5 percent of maximum Rice density. AASHTO T 209. For small projects with plan quantities of HMA less than 3000 tons or for work such as utility work, traffic signals, detours, or lane leveling and when material is to be accepted on the basis of visual inspection per article 1.4 "Acceptance," paragraph B, acceptance for density may be based upon establishing and maintaining a roller pattern to obtain maximum density without over-stressing the pavement.
1. Obtain a minimum of two density determinations on a random basis for each subplot. ASTM D 3665.
 2. When samples for gradation, asphalt binder content and VMA from lots are combined according to Part 3, article 3.9 "Dispute Resolution," in order to obtain an appropriate sample size for evaluation, a lot for density determination is defined as the combined production days.
- E. Thickness: Base acceptance on the average thickness of a lot. A thickness lot equals a density lot. Divide a thickness lot into five sublots equal to density sublots. Thickness acceptance for thin lift projects (2 inches or less) consists of checking thickness regularly with a depth probe during placement and taking corrective action as necessary.
1. Take a minimum of two randomly selected thickness tests within each subplot.
 2. The same core samples taken for density may be used for thickness verification.
 3. The Department accepts a lot when:
 - a. The average thickness of all sublots is not more than 1/2 inch greater nor 1/4 inch less than the total thickness specified.
 - b. No individual subplot shows a deficient thickness of more than 3/8 inch.
 - c. Place additional materials where lots or sublots are deficient in thickness. The minimum depth of compacted surface for correcting deficient thickness is 3 times the nominal maximum aggregate size.
 - d. The Department pays for the quantity of additional material to bring the surface to design grade.

- e. The Department does not pay for the quantity of additional material above the design grade due to the minimum paving thickness required.
 - f. The Engineer may allow excess thickness to remain in place or may order its removal. Remove and replace the entire depth of the course, if it is necessary to remove portions of the course.
 - g. The Department pays for 50 percent of the mix in excess of the +1/2 inch tolerance when excess thickness is allowed to remain in place.
 - h. The thickness tolerances established above do not apply to leveling courses. However, check final surfaces in stage construction.
- F. Smoothness Tests
 - 1. Determine acceptance and correct in accordance with Section 01452.
- G. Cease production when any two out of three consecutive lots have a net disincentive or the air voids averaged for each lot are not between 3 and 5 percent for any 2 out of 3 consecutive lots.
 - 1. Before production continues, submit a corrective action plan to the Engineer indicating the changes in production procedures that will be implemented to correct the deficiencies.
- H. The Department pays incentive/disincentive on the assessed quantities of HMA mix according to Table 1 Incentive/Disincentive for Gradation, Asphalt Binder Content and Density or Table 2 Incentive/Disincentive for VMA. Base the incentive/disincentive on Percent Within Limit (PT) computation using Tables 3, 4, and 5. Use lowest single value combined for gradation (each of the sieves) and asphalt binder content for calculating the gradation/asphalt binder content incentive/disincentive in Table 1.
 - 1. Meet PT of 88 or greater for density for eligibility for incentive in gradation/asphalt binder content and VMA. The Department does not pay incentive for gradation/asphalt binder content and VMA if the Contractor does not meet this condition.
 - 2. For small projects with plan quantities of HMA less than 3000 tons, or for work such as utility work, traffic signals, detours, or lane leveling and when material is accepted on the basis of visual inspection per article 1.4 "Acceptance," paragraph B, incentives/disincentives do not apply.
- I. The Department rejects the lot if the Percent Within Limits (PT) for any individual measurement is less than 60 percent.
- J. To reduce over-testing of small quantity production days such as ramps or bridgework, the Engineer may, in concurrence with the Contractor, choose to combine production from several days to form a single lot.

Table 1 Incentive/Disincentive for Gradation, Asphalt Binder Content and Density			
Gradation/Asphalt Binder Content		Density	
PT Based on Min. Four Samples	Incentive/Disincentive (Dollars/Ton)	PT Based on Min. Ten Samples	Incentive/Disincentive (Dollars/Ton)
> 99	0.83	> 99	0.83
96-99	0.67	96-99	0.67
92-95	0.37	92-95	0.37
88-91	0.06	88-91	0.06
84-87	-0.24	84-87	-0.24
80-83	-0.54	80-83	-0.54
76-79	-0.84	76-79	-0.84
72-75	-1.15	72-75	-1.15
68-71	-1.45	68-71	-1.45
64-67	-1.75	64-67	-1.75
60-63	-2.06	60-63	-2.06
<60	Reject	<60	Reject

Table 2 Incentive/Disincentive for VMA	
PT Based on Minimum Three Samples	Incentive/Disincentive (Dollars/Ton)
> 99	0.49
96-99	0.39
92-95	0.18
88-91	-0.03
84-87	-0.24
80-83	-0.44
76-79	-0.64
72-75	-0.85
68-71	-1.06
64-67	-1.27
60-63	-1.47
<60	Reject

Table 3 Upper and Lower Limit Determination	
Parameter	UL and LL
3/4 inch sieve for 1 inch HMA 1/2 inch sieve for 3/4 inch HMA 3/8 inch sieve for 1/2 inch HMA No. 4 sieve for 3/8 inch HMA	Target Value " 6.0%
No. 8 sieve	Target Value " 5.0%
No.50 sieve	Target Value " 3.0%
No. 200 sieve	Target Value " 2.0%
Asphalt Binder Content	Target Value " 0.35%
VMA Production Range	Field Target Value \pm 1.25%
Target Range (Field)	12.5 % - 13.5 % for 1 inch 13.5 % - 14.5 % for 3/4 inch 14.5 % - 15.5 % for 1/2 inch 15.5 % - 16.5 % for 3/8 inch
Target Range (Design)	Modified as necessary to meet field target range
Density	Lower Limit: Target Value - 2.0% Upper Limit: Target Value + 3.0%

Table 4 Quality Index Values for Estimating Percent Within Limits										
PU/PL	n=3	n=4	n=5	n=6	n=7	n=8	n=10	n=12	n=15	n=20
100	1.16	1.50	1.75	1.91	2.06	2.15	2.29	2.35	2.47	2.56
99	1.16	1.47	1.68	1.79	1.89	1.95	2.04	2.09	2.14	2.19
98	1.15	1.44	1.61	1.70	1.77	1.80	1.86	1.89	1.93	1.97
97	1.15	1.41	1.55	1.62	1.67	1.69	1.74	1.77	1.80	1.82
96	1.15	1.38	1.49	1.55	1.59	1.61	1.64	1.66	1.69	1.70
95	1.14	1.35	1.45	1.49	1.52	1.54	1.56	1.57	1.59	1.61
94	1.13	1.32	1.40	1.44	1.46	1.47	1.49	1.50	1.51	1.53
93	1.12	1.29	1.36	1.38	1.40	1.41	1.43	1.43	1.44	1.46
92	1.11	1.26	1.31	1.33	1.35	1.36	1.37	1.37	1.38	1.39
91	1.10	1.23	1.27	1.29	1.30	1.31	1.32	1.32	1.32	1.33
90	1.09	1.20	1.23	1.24	1.25	1.25	1.26	1.26	1.27	1.27
89	1.08	1.17	1.20	1.21	1.21	1.21	1.21	1.21	1.22	1.22
88	1.07	1.14	1.16	1.17	1.17	1.17	1.17	1.17	1.17	1.17
87	1.06	1.11	1.12	1.12	1.12	1.13	1.13	1.13	1.13	1.13
86	1.05	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08
85	1.03	1.05	1.05	1.05	1.05	1.04	1.04	1.04	1.04	1.04
84	1.02	1.02	1.02	1.01	1.01	1.01	1.00	1.00	1.00	1.00
83	1.00	0.99	0.98	0.97	0.97	0.96	0.96	0.96	0.96	0.96
82	0.98	0.96	0.95	0.94	0.94	0.93	0.93	0.92	0.92	0.92
81	0.96	0.93	0.92	0.91	0.90	0.90	0.89	0.89	0.89	0.88
80	0.94	0.90	0.88	0.87	0.86	0.86	0.85	0.85	0.85	0.85
79	0.92	0.87	0.85	0.84	0.83	0.83	0.82	0.82	0.82	0.81
78	0.89	0.84	0.82	0.81	0.80	0.79	0.79	0.78	0.78	0.78
77	0.87	0.81	0.79	0.78	0.77	0.76	0.76	0.75	0.75	0.75
76	0.84	0.78	0.76	0.75	0.74	0.73	0.72	0.72	0.72	0.72
75	0.82	0.75	0.73	0.72	0.71	0.70	0.69	0.69	0.69	0.68
74	0.79	0.72	0.70	0.68	0.67	0.67	0.66	0.66	0.66	0.65
73	0.77	0.69	0.67	0.65	0.64	0.64	0.62	0.62	0.62	0.62
72	0.74	0.66	0.64	0.62	0.61	0.61	0.60	0.59	0.59	0.59
71	0.71	0.63	0.60	0.59	0.58	0.58	0.57	0.56	0.56	0.56
70	0.68	0.60	0.58	0.56	0.55	0.55	0.54	0.54	0.54	0.53
69	0.65	0.57	0.55	0.54	0.53	0.52	0.51	0.51	0.51	0.50
68	0.62	0.54	0.52	0.51	0.50	0.50	0.48	0.48	0.48	0.48
67	0.59	0.51	0.49	0.48	0.47	0.47	0.46	0.45	0.45	0.45
66	0.56	0.48	0.46	0.45	0.44	0.44	0.43	0.42	0.42	0.42
65	0.53	0.45	0.43	0.42	0.41	0.41	0.40	0.40	0.40	0.39
64	0.49	0.42	0.40	0.39	0.38	0.38	0.37	0.37	0.37	0.37
63	0.46	0.39	0.37	0.36	0.35	0.35	0.35	0.34	0.34	0.34
62	0.43	0.36	0.34	0.33	0.33	0.33	0.32	0.31	0.31	0.31
61	0.39	0.33	0.31	0.30	0.30	0.30	0.29	0.29	0.29	0.28
60	0.36	0.30	0.28	0.27	0.26	0.26	0.25	0.25	0.25	0.25
<60	#0.35	#0.29	#0.27	#0.26	#0.25	#0.25	#0.24	#0.24	#0.24	#0.24

Enter table in the appropriate sample size column and round down to the nearest value.

Table 5

Definitions, Abbreviations, and Formulas for Acceptance	
Term	Explanation
Target Value (TV)	The target values for gradation, asphalt binder content and VMA are given in the Contractor's volumetric mix design. See article 1.4, D., line E, for density target values.
Average (AVE)	The sum of the lot's test results for a measured characteristic divided by the number of test results; the arithmetic mean.
Standard Deviation (s)	The square root of the value formed by summing the squared difference between the individual test results of a measured characteristic and AVE, divided by the number of test results minus one. This statement does not limit the methods of calculations of s; other methods that obtain the same value may be used.
Upper Limit (UL)	The value above the TV of each measured characteristic that defines the upper limit of acceptable production. (Table 3)
Lower Limit (LL)	The value below the TV of each measured characteristic that defines the lower limit of acceptable production (Table 3)
Upper Quality Index (QU)	$QU = (UL - AVE)/s$
Lower Quality Index (QL)	$QL = (AVE - LL)/s$
Percentage of Lot Within UL (PU)	Determined by entering Table 4 with QU.
Percentage of Lot Within LL (PL)	Determined by entering Table 4 with QL.
Total Percentage of Lot (PL) Within UL and LL (PT)	$PT = (PU + PL) - 100$
Incentive/Disincentive	Determined by entering Table 1 and 2 with PT or PL.

All values for AVE, s, QU, and QL will be calculated to two decimal place accuracy, which will be carried through all further calculations. Rounding to lower accuracy is not allowed.

PART 2 PRODUCTS

2.1 ASPHALT BINDER

- A. Refer to Special Provision 02742S: Project Specific Surfacing Requirements.
- B. Asphalt material: Refer to Section 02745.
- C. Sampling procedure: UDOT Materials Manual of Instruction Part 8-209
- D. Asphalt Binder Management Plan: UDOT Materials Manual of Instruction Part 8-209

2.2 AGGREGATE

- A. Refer to the Minimum Test Requirements.
- B. Crusher processed virgin aggregate material consisting of crushed stone, gravel, or slag. Conform to Section 02969 for recycled mixes.
- C. Use the following requirements, including Table 6, to determine the suitability of the aggregate.
 - 1. Coarse aggregates:
 - a. Retained on No. 4 sieve.
 - 2. Fine aggregates:
 - a. Clean, hard grained, and angular.
 - b. Passing the No. 4 sieve.

Table 6

Aggregate Properties - HMA			
Test Method	Test No.	Category 1	Category 2
One Fractured Face	ASTM D 5821	95% min.	85% min. (1 inch and 3/4 inch), and 90% min. (1/2 inch and 3/8 inch)
Two Fractured Face	ASTM D 5821	90% min.	80% min. (1 inch and 3/4 inch), and 90% min. (1/2 inch and 3/8 inch)
Fine Aggregate Angularity	AASHTO T 304	45 min.	45 min.
Flat and Elongated 1 to 3 ratio	ASTM D 4791 (Based on 3/8 inch sieve and above)	20% max.	20% max.
L.A. Wear	AASHTO T 96	35% max.	40% max.
Sand Equivalent	AASHTO T 176 (Pre-wet method)	60 min.	45 min.
Plasticity Index	AASHTO T 89 and T 90	0	0
Unit Weight	AASHTO T 19	min. 75 lb/cu. ft.	min. 75 lb/cu. ft.
Soundness (sodium sulfate)	AASHTO T 104	16 % max. loss with five cycles	16 % max. loss with five cycles
Clay Lumps and Friable Particles	AASHTO T 112	2% max	2% max.
Natural Fines	N/A	0%	10% max.
Category 1: National Highway System and Truck Routes - Table 11. Category 2: All Other Routes			

- D. Meet gradation requirements in Table 7.

Table 7

Aggregate Gradations (Percent Passing by Dry Weight of Aggregate)					
Sieve Size		1 inch (SHRP 25 mm)	3/4 inch (SHRP 19 mm)	1/2 inch (SHRP 12.5 mm)	3/8 inch (SHRP 9.5 mm)
Control Sieves	1-1/2 inch	100.0	-	-	-
	1 inch	90.0 - 100.0	100.0	-	-
	3/4 inch	<90	90.0 - 100.0	100.0	-
	1/2 inch	-	<90	90.0 - 100.0	100.0
	3/8 inch	-	-	<90	90.0 - 100.0
	No. 4	-	-	-	< 90
	No. 8	19.0 - 45.0	23.0 - 49.0	28.0 - 58.0	32.0 - 67.0
	No. 200	1.0 - 7.0	2.0 - 8.0	2.0 - 10.0	2.0 - 10.0

2.3 HYDRATED LIME

- A. Meet the requirements of Section 02746.

2.4 VOLUMETRIC DESIGN

- A. Comply with all requirements for Superpave Volumetric Mix Design according to Asphalt Institute, SP-1, and SP-2, AASHTO PP 28 and the following:
1. Meet the requirements of Table 8 and Table 9.
 2. Use a laboratory qualified by UDOT Central Materials in the use of the Superpave Gyratory Compactor. AASHTO T 312.
 3. Use an FHWA-protocol approved Superpave Gyratory Compactor.
 4. Meet all volumetric mix design requirements for the selected target gradation.
- B. Submit the Volumetric Mix Design data for verification at least 10 working days before beginning paving. Do not begin paving until verification is complete.
1. Include all information regarding selection of design aggregate structure showing the target values of percent passing on all sieves listed in Table 7, and the design asphalt binder content.
 2. Provide information that aggregate proposed for use meet the requirements of Table 6.
 3. Supply QC data for target job mix gradation selection. Use those target values for price adjustments.

4. After the design is complete, run 4 sets of 2 Gyratory specimens at the design asphalt binder content to verify the optimum asphalt and all other design requirements.
- C. Moisture Susceptibility
 1. Incorporate hydrated lime into all volumetric designs. Use 1 percent, minimum, for Method A and 1½ percent, minimum for Method B (Section 02746 – Hydrated Lime).
 - D. Designate asphalt binder supplier.
 - E. Use gyratory mixing and compaction temperatures supplied by the Engineer.
 - F. The Department Region Materials Lab verifies the Volumetric Mix Design. UDOT Materials Manual of Instruction Part 8-960: Guidelines for Superpave Volumetric Mix Design. For small projects with plan quantities of HMA less than 3000 tons, or for work such as utility work, traffic signals, detours, or lane leveling, the Region Materials Engineer may accept the Volumetric Mix Design from data submitted with the proposed mix design or from a previous mix design. The Region Materials Engineer reserves the right to verify any mix design submitted.
 - G. Comply with the following requirements for Superpave volumetric mix design:

Table 8

Volumetric Design Gyration				
20 Years Design ESALS (Million)	Compaction Parameters			Voids Filled with Asphalt (VFA) (%)
	N_{initial} /% of G_{mm} *	N_{design} /% of G_{mm} *	N_{max} /% of G_{mm} *	
0.3	6/ # 91.5	50/ ≥ 96.5	75/ # 98	70 - 80 **
0.3 to <3	7/ # 90.5	75/ ≥ 96.5	115/ # 98	65 - 78
3 to < 30	8/ # 89	100/ ≥ 96.5	160/ # 98	65 - 75
\$30	9/ # 89	125/ ≥ 96.5	205/ # 98	65 - 75

* G_{mm}: Maximum specific gravity of Mix. (Rice Method)

** 67 percent specified lower limit VFA for 1 inch nominal maximum size mixture.

Table 9

Volumetric Design Requirements	
HMA design mixing and compaction temperatures	Provided by the Engineer
Dust Proportion Range	0.6 - 1.40
Voids in Mineral Aggregate (VMA) at N_{design} AASHTO PP 28.9.2, using G_{sb} at SSD. Equation based on percent of total mix.	Sufficient to Achieve Field Performance (Submit calculations or documentation to substantiate)
Hamburg Wheel Tracker UDOT Materials Manual of Instruction Part 8-990	Maximum 10 mm impression at 20,000 cycles.

- H. Prepare and submit 2 sets (5 samples each) of ignition oven calibration samples.
1. Department uses these samples to determine the correction factors for the Region and Field lab ignition oven.
 2. Submit samples a minimum of three working days prior to paving.

2.5 CONTRACTOR INITIATED CHANGES IN MIX DESIGN

- A. Submit all requests in writing at least 12 hours prior to incorporating changes into production.
- B. Submit a field volumetric mix design for all target changes.
1. Field volumetric mix design verification consists of 3 sets of 2 gyratory specimens run at the new target gradation and/or asphalt binder content. The Department's previous acceptance tests are allowed for field verification.
 2. If the field volumetric mix design meets the volumetric requirements, the Engineer, in consultation with the Region Materials Engineer, provides written concurrence of the verified field volumetric mix design.
 3. If the field volumetric mix verification does not meet the volumetric requirements, submit a new laboratory volumetric mix design from a laboratory qualified by UDOT Central Materials. Allow at least 4 working days for verification.
 4. The Department performs up to two volumetric mix design verifications at no cost to the Contractor. The Department charges \$3000 for each additional laboratory and/or field verification required, including all laboratory or field volumetric mix design verifications required due to contractor initiated target changes.

- C. Submit a new laboratory volumetric mix design if changes occur in the aggregate source, asphalt binder source or grade.
- D. Do not make changes to production mix until request is reviewed and verified.

PART 3 EXECUTION

3.1 ADDING HYDRATED LIME

- A. Method A, Lime Slurry; or Method B, Lime Slurry Marination: Refer to Section 02746.

3.2 HMA

- A. Dry aggregate to an average moisture content of not more than 0.2 percent by weight. AASHTO T 255. Adjust burners to avoid damage or soot contamination of the aggregate.
- B. Coat with asphalt binder 100 percent of the particles passing and 98 percent of the particles retained on the No. 4 sieve.
 - 1. AASHTO T 195.
 - 2. Discontinue operation and make necessary corrections if material is not properly coated.
- C. Maintain temperature of the HMA between established limits.
 - 1. Do not overheat the material or cause thermal damage to the asphalt binder.
 - 2. Department rejects and Contractor removes materials heated over the established limits.
 - 3. Remove all material rejected by the Department for overheating.

3.3 HMA PLANT

- A. Provide:
 - 1. Positive means to determine the moisture content of aggregate.
 - 2. Positive means to sample all material components.
 - 3. Sensors to measure the temperature of the HMA at discharge.
 - 4. The ability to maintain discharge temperature of the mix in accordance with the mix design.
- B. Asphalt Binder Storage Tanks:
 - 1. Provide calibrated tanks so the quantity of material remaining in the tank can be determined at any time.

2. Provide a positive means of sampling the asphalt binder from the tanks.

3.4 SURFACE PREPARATION

- A. Locate, reference, and protect all utility covers, monuments, curb and gutter, and other components affected by the paving operations.
- B. Remove all moisture, dirt, sand, leaves, and other objectionable material from the prepared surface before placing the mix.
- C. Complete spot leveling 48 hours before placing pavement courses.
 1. Place, spread, and compact leveling mix on portions of the existing surface.
 2. Fill and compact any localized potholes more than 1 inch deep.
- D. Allow sufficient cure time for prime coat/tack coat prior to placing HMA. Refer to Section 02748.

3.5 SURFACE PLACEMENT

- A. When full-width or echelon paving is impractical and more than one pass is required, provide a 3:1 (horizontal to vertical) sloped edge adjacent to the next lane to be paved.
- B. Adjust the production of the mixing plant and material delivery until a steady paver speed is maintained.
- C. Offset longitudinal joints 6 to 12 inches in succeeding courses.
 1. Place top course joint within one foot of the centerline or lane line.
 2. If the previous pass has cooled below 175°F, tack the longitudinal edge before placing the adjacent pass.
- D. Offset transverse construction joints at least 6 ft longitudinally to avoid a vertical joint through more than one course.
- E. Do not allow construction vehicles, general traffic, or rollers to pass over the uncompacted end or edge of freshly placed mix until the mat temperature drops to a point where damage or differential compaction will not occur.
- F. Taper the end of a course subjected to traffic at approximately 50:1 (horizontal to vertical).
 1. Make a transverse joint by saw or wheel cutting and removing the portion of the pass that contains the tapered end.

2. Tack the contact surfaces before fresh mix is placed against the compacted mix.
- G. Use a motor grader, spreader box, or other approved spreading methods for projects under 180 yd², irregular areas, or for miscellaneous construction such as detours, sidewalks, and leveling courses.

3.6 COMPACTION

- A. Use a small compactor or vibratory roller in addition to normal rolling at structures.
- B. Operate in a transverse direction next to the back wall and approach slab.

3.7 LIMITATIONS

- A. Do not place HMA on frozen base or subbase.
- B. Use a UDOT approved release agent for all equipment and hand tools used to mix, haul, and place the HMA. Select from the Performance Data Products Listing (PDPL) maintained by the UDOT Research Division.
- C. Do not place HMA during adverse climatic conditions, such as precipitation, or when roadway surface is icy or wet.
- D. Place HMA from April 15, and October 15, and when the air temperature in the shade and the roadway surface temperature are above 50 degrees F.
 1. The Department determines if it is feasible to place HMA outside the above limits. Obtain written approval from the Engineer prior to paving from October 15, to April 15.

3.8 CONTRACTOR QUALITY CONTROL

This Section does not apply to projects of 20,000 tons or less.

- A. General
 1. Reference the following standards for qualification, control, and guidelines:
 - a. ASTM D 3666
 - b. ASTM D 4561
 - c. ASTM D 5506
 2. Include the following tests in ASTM D 5506, Part 2, "Referenced Documents," for the following:
 - a. AASHTO T 308
 - b. AASHTO T 312, PP 28

- c. AASHTO T 283 Modified by UDOT Materials Manual of Instruction Part 8-957
 - d. ASTM E 1274
- 3. Establish and maintain a quality control system providing assurance that materials and completed construction conform to Contract requirements.
- 4. Identify the Quality Control Manager by name. The Quality Control Manager implements and maintains the Quality Control Plan.
- 5. Provide the Engineer a certification stating that all the testing equipment to be used is properly calibrated and meets the specifications applicable for the specified test procedures. Provide evidence that Technicians are WAQTC certified. The Engineer may require the Contractor's technician to perform testing of samples to demonstrate an acceptable level of performance.
- 6. Perform split-sample, paired-T testing with the Department based on project quality control testing using an AASHTO accredited lab.
 - a. Perform split-sample, paired-T analysis on all mix acceptance tests related to volumetric properties and the following background testing:
 - i. Maximum Specific Gravity of Mix
 - ii. Bulk Specific Gravity of Mix
 - iii. Bulk Specific Gravity of Coarse Aggregates
 - b. Continue until attaining successful Paired-T test results, meeting $\alpha = 0.05$, for a minimum of two consecutive production days.

B. Quality Control Plan (QCP)

- 1. Provide and maintain a Quality Control Plan covering all personnel, equipment, supplies, and facilities necessary to obtain samples, perform and document tests, and otherwise provide a quality product.
- 2. Submit the written QCP to the Engineer at least 10 days before beginning operations, or at the Preconstruction Conference.
- 3. The Department makes no partial payments for materials that are subject to specific quality control requirements without a QCP.
- 4. The Contractor or independent organization may operate the QCP. However, the Contractor is responsible for the QCP's administration, including compliance with the QCP and any modifications.
- 5. Address the following minimum items:
 - a. Quality control organization chart and area of responsibility and authority of each individual.
 - b. Names and qualifications of personnel as required by this Section, article "Quality Control Organization Personnel Requirements."
 - c. Provide a description of outside organizations and their services (such as testing laboratories) if employed.
 - d. Tests required to be performed, the frequency of testing, sampling locations, and location of the testing facilities.

- e. Documentation of test procedures verifying that tests are conducted in accordance with the testing plan, and that proper corrective actions are taken when required.
- f. Procedures for verifying that testing equipment is available, complies with specified standards, and is calibrated against certified standards.
- g. Procedures for verifying that tests are conducted in accordance with the appropriate ASTM and AASHTO standards.
- h. Procedures for submitting test results to the Engineer daily.
- 6. QCP elements: address all elements that affect the quality of the HMA including:
 - a. Mix Design
 - b. Aggregate Grading
 - c. Quality of Materials
 - d. Stockpile Management
 - e. Proportioning
 - f. Mixing
 - g. Placing and Finishing
 - h. Sampling and Testing Procedures
 - i. Joints
 - j. Compaction
 - k. Surface smoothness

C. Quality Control Organization

- 1. Implement the QCP by:
 - a. Establishing a separate Quality Control Organization.
 - b. Developing an organization chart to show all quality control personnel and how these personnel integrate with other management, production, and construction functions and personnel.
- 2. Identify all quality control staff on the organization chart by name and function, and indicate the total staff required to implement all elements of the quality control programs, including inspection and testing functions for different items of work.
- 3. If an outside organization or laboratory is used to implement all or part of the QCP, the personnel assigned are subject to the qualification requirements of this Section. Indicate on the organization chart which personnel are contractor employees and which are provided by an outside organization.

D. Quality Control Organization Personnel Requirements

- 1. As outlined in ASTM D 3666, Part 7, with the following modifications.

Quality Control Manager:

 - a. Institutes any actions necessary to successfully operate the QCP in compliance with specifications.

- b. Reports directly to a responsible officer in the Contractor's organization.
 - c. May supervise the QCP on more than one project provided that the Quality Control Manager can be at the job site within one hour after being notified of a problem.
 - 2. Certification of Personnel. As outlined in ASTM D 5506 with the following changes:
 - a. Provide a sufficient number of quality control technicians to adequately implement the QCP. These personnel will be either engineers or engineering technicians certified by WAQTC.
 - 3. Quality Control Technicians:
 - a. Report directly to the Quality Control Manager.
 - b. Inspect all plant equipment used in proportioning and mixing to verify proper calibration and operating condition.
 - c. Perform quality control tests necessary to adjust and control mix proportioning in accordance with the job mix formula.
 - d. Inspect all equipment used in placing, finishing, and compaction to verify proper operating condition.
 - e. Inspect all construction operations to verify conformance with the specifications.
 - f. Perform all quality control testing as required by this Section, article "Quality Control Testing."
 - g. Detail the criteria to be used in initiating correction of unsatisfactory production processes and construction practices.
- E. Quality Control Testing Laboratory
 - 1. Reference ASTM D 4561 with the following additions:
 - a. Provide a fully equipped asphalt laboratory located within 30 minutes travel time of the plant or job site.
 - b. Keep laboratory facilities clean and all equipment maintained in proper working condition.
 - c. Permit the Engineer unrestricted access to inspect the quality control testing laboratory facility and witness quality control activities. The Department advises in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies or testing personnel and procedures.
 - d. Suspend work when test results indicate materials are out of specification tolerances. Resume only when the deficiencies are corrected.
 - i. Perform quality audits under this standard.
 - ii. Refer to UDOT QA Manual.
 - 2. Sampling:
 - a. Use a statistically based procedure of random sampling. ASTM D 3665.

- b. The Engineer has the right to witness all sampling. UDOT Materials Manual of Instruction Part 8-984: Sampling Methods.
 - 3. Noncompliance:
 - a. When quality control activities do not comply with either the Quality Control Program or the Contract provisions, or failure to properly operate and maintain an effective Quality Control Program, the Engineer may:
 - i. Order replacement of ineffective or unqualified personnel.
 - ii. Carry out the functions and operation of the approved Quality Control Program.
 - iii. Deduct costs incurred by the Department to operate the program or otherwise remedy the noncompliance from the total amount due the Contractor.
- F. Quality Control Testing
 - 1. Perform all quality control tests necessary to control the production and construction processes applicable to these specifications and listed in the QCP.
 - 2. Establish a testing program to control as a minimum: asphalt binder content, aggregate gradation, VMA, temperatures, aggregate moisture, field compaction, and surface smoothness.
 - 3. Monitoring: The Department reserves the right to monitor any QC testing.
 - 4. Follow the requirements of Table 10, and conduct any additional testing to control the process.

Table 10

Quality Control Testing for HMA	
Testing Method/ Acceptance Documentation	Testing Frequency
AASHTO T 308 Asphalt binder content: by the ignition method	Minimum 4 tests per lot **
AASHTO T 30 Gradation: Mechanical analysis of the remains of the Ignition test.	Minimum 4 tests per lot
AASHTO T 255 Moisture content: of aggregate used in production by drying	Minimum One test per lot
Temperature for: dryer, bitumen in the storage tank, mixture at the plant, and mixture at the job site.	Record at least four times per lot
ASTM D 2950 In-place Density Monitoring Conduct all testing necessary to meet density requirements.	Minimum 10 density determinations per lot
AASHTO T 312, PP 28 Field Gyratory Specimens Verify mix design parameters meet Job-mix requirements, and adjust mix as needed to meet parameters. Mold field gyratory specimens at mix design temperatures determined by the Engineer.	Minimum of one determination (two Gyratory specimens each) of VMA and Air Voids for each lot.

** A lot is defined in article 1.4

G. Control Charts

1. Maintain daily linear control charts both for mean and range. Include in charts aggregate gradation, asphalt binder content, stockpile gradation, VMA, Density and in-place air voids.
2. Post control charts daily in a location satisfactory to the Engineer. As a minimum, identify:
 - a. Project number
 - b. Contract item number
 - c. Test number
 - d. Each test parameter

- e. Test results
 - 3. Use the control charts as part of a process control system for identifying potential problems and assignable causes before they occur. If the projected data during production indicates a problem and no corrective action is taken, the Engineer may suspend production or acceptance of the material.
- H. Quality Control Reports
- 1. Maintain records and submit daily reports of quality control activities.

3.9 DISPUTE RESOLUTION

- A. When disputing the validity of the Department's acceptance tests, submit an engineering analysis within one week of receipt of test results.
- B. At a minimum, include the following items in the engineering analysis:
 - 1. Data supporting the Contractor's test results. Data must be based on project quality control testing performed by an AASHTO accredited lab that has performed a split-sample process with the Department and includes:
 - a. Split-sample testing performed within the applicable contract
 - b. Test data disputed along with:
 - i. Maximum Specific Gravity of Mix
 - ii. Bulk Specific Gravity of Mix
 - iii. Bulk Specific Gravity of Coarse Aggregates
 - c. Successful Paired-T test information, meeting $\alpha = 0.05$, for a minimum of two consecutive production days
 - 2. Procedures or issues leading to disputed acceptance test results.
 - 3. Determination of volumetric, durability and long-term structural properties from one or more of the following tests:
 - a. Hamburg Rut Tester
 - b. 5-Cycle Lottman
 - c. Asphalt Pavement Analyzer - Rut and Fatigue tests
 - d. Resilient Modulus
 - e. SHRP PG Asphalt Binder Tests
 - f. SHRP Gyrotory Compactor
 - 4. Incentive/Disincentive calculations based on Contractor and Department test values.
 - 5. Recommendations for price adjustment based on expected long-term performance.
- C. When paving plans indicate that a reject lot will be covered within 48 hours, the Department immediately reviews the analysis to identify possible discrepancies that can be resolved through validation testing based on the following:

1. Department performs repeat testing on remaining material from original Department test.
 2. Department personnel perform repeat testing in the presence of Contractor representative within a 24 hour time period.
 3. Use results to validate or invalidate original Department result. Validation test results may not be used in lieu of acceptance results.
 4. Base validation on results within two standard deviations (project acceptance samples) of original acceptance result. Remove invalidated test results from acceptance lot and reevaluate lot based on reduced sample size.
 5. The Engineer reviews the results and notifies the Contractor of any findings that affect the reject status of the lot along with the Department's position on whether the lot is to be removed or may remain in place at the \$15.00/ton deduction for Reject Lot.
- D. Within three working days of receipt, the Resident Engineer, Region Materials Engineer, and Region Construction Engineer review the analysis and notify the Contractor in writing of acceptance or rejection. Notification of rejection includes the following:
1. Engineering basis for rejecting the Contractor's analysis, including specific points of objection.
 2. Department data and analysis to justify Department position.
 3. Time frame for removal of material or pay adjustment to be applied to the lot.
- E. When the Department concludes the engineering analysis has merit, the Department, in conjunction with the Contractor, immediately begins a review of the acceptance test results. The review includes, but is not be limited, to the following:
1. Independent Assurance review of all equipment and procedures and methods used for sampling, splitting, and testing.
 2. A review of the Department and Contractor's raw test data and calculations for documentation or calculation errors.
 3. Production and testing of additional correlation samples.
 4. Cross-witnessing of test procedures by Contractor Quality Control and Department personnel.
 5. Distribution any other pertinent information.
 6. Discussion of other possible means for variation.

Note: If engineering analysis is initiated due to failure of statistical methods to verify Contractor testing and there is no net difference between incentive/disincentive based on Contractor or Department testing, the Engineer may verify contractor test values based on engineering analysis.

- F. Do not continue production without concurrence from the Engineer or until differences in the test results are resolved.
- G. If errors in testing or reporting are discovered, the Department corrects the applicable test results and re-applies the acceptance/pay adjustment procedures.
 - 1. If errors are identified that cannot be corrected and the quality of the lot is in question, the Department may choose to evaluate the lot using the Hamburg Wheel Tracker or the Asphalt Pavement Analyzer.
 - a. Use 5 stratified random samples cut from the roadway
 - b. The Region Materials Engineer and Resident Engineer decide, in conjunction with the Contractor, the status of the lot and associated pay adjustment, based on the following:
 - i. Fatigue Life
 - ii. Stripping Potential
 - iii. Rutting Potential
 - iv. Expected Pavement Performance Period vs. Design Life
 - 2. Errors that are identified within the Department's testing result in a review of the Contractor's schedule and if appropriate, make adjustments to the CPM.
- H. If errors in testing cannot be identified, select an Independent Third Party (Agreed on by the Department and the Contractor) to witness sample splitting and testing by both the Contractor and the Department. The Independent Third Party identifies/produces additional material for split-sample testing.
- I. If testing errors are identified by the Third Party, the Department makes appropriate adjustments to the acceptance test results and re-applies the acceptance/pay adjustment procedures.
- J. The party responsible for the identified error pays for the services of the Independent Third Party.
- K. If no errors are identified, the Department evaluates the lot using the original testing results.

Table 11

National Highway System and Truck Routes Category 1		
Interstate Routes	Beginning	Ending
1-15	Arizona State Line	Idaho State Line
1-70	Jct I-70 - Cove Fort	Colorado State Line
1-80	Nevada State Line	Wyoming State Line
1-84	Idaho State Line	Jct I-80 - Coalville
1-215	Jct I-80 - Parleys Canyon	Jct I-15 - North Salt Lake
US Routes		
US-6	Nevada State Line	Jct US-50 - Delta
US-6	Jct I-15 - Spanish Fork	Jct I-70 - Green River
US-40	Jct I-80 - Park City	Colorado State Line
US-50	Jct US-6 - Delta	Jct I-15 - Holden
US-89	Arizona State Line	Jct I-70 - Sevier
US-89	Jct I-70 - Salina	Jct SR-28 - Gunnison
US-89	Jct US-6 - Spanish Fork	Jct SR-73 - Lehi
US-89	Jct I-15 - Draper, Exit 295	Jct SR-269 - 5 th and 6 th South
US-89	Jct I-15 - Farmington	Jct I-80 - Uintah
US-89	Jct I-84 - Uintah	Jct SR-134 - North Ogden
US-89	Jct US-91 - Logan	Idaho State Line
US-91	Jct I-15 - Brigham City	Jct US-89 - Logan
US-189	Jct I-15 - South Provo	Jct US-40 - Heber City
US-191	Arizona State Line	Jct I-70 - Thompson
US-666	Jct US-191 - Monticello	Colorado State Line

State Routes	Beginning	Ending
SR-9 - Zions Park		
SR-10 - Castle Valley	Jct I-70 - Fremont Jct	Jct US-6 - Price
SR-12 - Bryce Canyon	Jct US-89 - Panguitch	Jct SR-63 - Bryce Canyon
SR-26 – Riverdale Road	Jct I-15 - Exit 342	Jct US-89 - Ogden
SR-28 - Levan Desert	Jct US-89 - Gunnison	Jct I-15 - South Nephi
SR-31 - Huntington	Mile Post 33	Mile Post 49
SR-36 - Tooele Access	Jct entrance - Tooele Army Depot	Jct I-80 - Tooele Interchange
SR-39 - 20th and 21st Ogden	Jct I-15 - Exit 344	Jct SR-203 - Harrison Blvd
SR-52 - 8th North, Orem	Jct I-15 - Orem	Jct US -189 - Olmstead Jct
SR-57 - Orangeville Bypass	Jct SR-10 - Hunter Power Plant	Entrance - Wilberg Coal Mine
SR-71 - 7th and 9th East Street, Salt Lake City	Jct SR0-209 - 90th South Street	Jct SR-186 - 4 th South Street
SR-73 - Lehi Connection	Jct I-15 - South Lehi	Jct US-89 - South Lehi
SR-79 - 12th Street Ogden	Jct I-15 - Exit 347	Jct SR-203 - Harrison Blvd.
SR-96 - Scofield Access	Mile Post 3	Mile Post 4
SR-111 - Bacchus Highway	Jct SR-48 - Bingham Highway	Jct SR-201 - 21 st South Expressway
SR-134 - 2700 North	Jct I-15 - North Ogden, Exit 352	Jct US-89 - North Ogden
SR-152 - Van Winkle Expressway	Jct SR-71 - 9th East Street	Jct I-215 - East (Exit 8)
SR-154 - Bangerter Highway	Jct I-15 - Draper	Jct I-80 - Salt Lake Intl Airport
SR-171 - 33rd and 35th South, Salt Lake City	Jct SR-172 - 56 th West Street	Jct I-215 - East, Exit 3
SR-172 - 56th West Street Salt Lake City	Jct 6200 South - Kearns	Jct I-80 - International Center
SR-186 Foothill Blvd	Jct SR-71 - 7 th East Street, SLC	Jct I-215 - East (Exit 1)
SR-190 - Big Cottonwood	Jct I 215 - East, Exit 7, SLC	Jct SR-210 - Little Cottonwood
SR-201 - 21st South Expressway	Jct I-80 - Lake Point	Jct I-15 - South Salt Lake
SR-203 - Harrison Blvd	Jct US-89 - South Ogden	Jct SR-39 - 12 th Street

State Routes	Beginning	Ending
SR-209 - 90th & 94th South	Jct SR-68 - Redwood Road (SLC)	Jct SR-210 - Little Cottonwood
SR-210 - Little Cottonwood	Jct SR-190 - Big Cottonwood	Jct SR-209 - 90 th and 96 th South
SR-264 - Skyline Mine Road	Mile Post 12	Mile Post 15
SR-265 - University Parkway	Jct I-15 - Exit 272	Jct I-215 East, Exit 5
SR-266 - 45th & 47th South Taylorsville	Jct I-215 - West, Exit 15	Jct I-215 - East, Exit 5
SR-269 - 5th & 6th South Salt Lake City	Jct I-215, Exit 310	Jct SR-71 - 7 th East Street

END OF SECTION

Change One - August 29, 2002

Revised Articles

3.8 E 2 a

3.8 E 2 b

Change Two – December 19, 2002

No changes made

Change Three – February 27, 2003

Revised Articles

1.4 C6a added

1.4 H

Table 3

2.4 A

2.4 C

Table 9

2.5 B 1-3

2.5 B 4 added

2.5 D

3.1 A1 deleted

3.2 C3 added

3.7 D1

3.9 B4

3.9 B5 added

3.9 E note added

Change Four – April 24, 2003

Revised Articles

3.7 B

SECTION 02752

PORTLAND CEMENT CONCRETE PAVEMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Materials and procedures for constructing Portland Cement Concrete Pavement.

1.2 RELATED SECTIONS

- A. Section 00555: Prosecution and Progress.
- B. Section 01452: Profilograph.
- C. Section 03055: Portland Cement Concrete.
- D. Section 03152: Concrete Joint Control.
- E. Section 03211: Reinforcing Steel and Welded Wire.
- F. Section 03390: Concrete Curing.

1.3 REFERENCES

- A. AASHTO M 154: Air Entraining Mixtures for Concrete.
- B. AASHTO M 157: Ready-Mixed Concrete.
- C. AASHTO T 11: Materials Finer Than 75 Fm (No. 200) Sieve in Mineral Aggregates by Washing.
- D. AASHTO T 23: Making and Curing Concrete Test Specimens in the Field.
- E. AASHTO T 24: Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
- F. AASHTO T 26: Quality of Water to be Used in Concrete.

- G. AASHTO T 27: Sieve Analysis of Fine and Coarse Aggregates.
- H. AASHTO T 97: Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).
- I. AASHTO T 119: Slump of Portland Cement Concrete.
- J. AASHTO T 121: Weight Per Cubic Foot, Yield, and Air Content (Gravimetric) of Concrete.
- K. AASHTO T 141: Sampling Fresh Concrete.
- L. AASHTO T 152: Air Content of Freshly Mixed Concrete by the Pressure Method.
- M. AASHTO C 457: Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete.
- N. ASTM D 3405: Joint Sealant, Hot-Applied, for Concrete and Asphalt Pavements.

1.4 SUBMITTALS

- A. Profilograph: Submit to the Engineer the day following testing, a copy of measured profile data and generated graphic reports containing a scaled reproduction of the measured profile with stationing, deviation information, and document points.
- B. Concrete:
 - 1. Use 3A(AE).
 - 2. Refer to Section 03055.
 - 3. Furnish the Engineer with mix design, trial batch gradation, and 28-day compressive strength test results from the trial batches before placing concrete.
 - 4. Use the same materials and admixtures intended for production in the trial batches.
 - 5. From the batch trial results, determine the cement content, aggregate ratio, and quantities of other mix components necessary to meet a design 28-day compressive strength of 5210 psi and a 7-day flexural strength of 490 psi.
 - 6. The proportioning and mixing of the trial batches are subject to inspection.
 - 7. Do not place pavement before obtaining written approval of the mix design.
 - 8. Meet the approved trial batch proportions. Changes in the mix proportions require new trial batches.

1.5 PROJECT CONDITIONS/LIMITATIONS

- A. **Seasonal:** Do not pave from October 15 to April 15. Submit cold weather concrete plan to the Engineer for written approval to pave outside these limits.
- B. **Hot Weather and Cold Weather:** Refer to Section 03055, Part 3.
- C. **Night Operations:** Provide proper lighting from one-half hour after sunset to one-half hour before sunrise following Section 00555, article, "Limitation of Operations."

1.6 ACCEPTANCE - OVER LEAN OR UNTREATED BASE COURSE

- A. Thickness acceptance is determined by core lengths located randomly one core per 12,000 ft² area.
- B. Core lengths:
 - 1. Engineer divides the pavement into consecutive areas not to exceed 12,000 ft².
 - 2. Add a final area of less than 6,000 ft² to the previous section to make one section.
 - 3. A final area of greater than 6,000 ft² will constitute a separate area.
 - 4. Hand-placement areas will be considered separately. Take one core per placement area.
- C. Engineer takes three measurements on each core and records to the nearest 1/16 in. Use the average to determine the acceptability and pay factors for deficient thickness areas using Table 2 of Section 02752 found in Measurement and Payment in the Bid Book.
- D. Engineer takes two additional cores for any deficient core (one on each side) where the thickness varies by 1/8 in. Locate the new core between the deficient core and each of the adjacent cores.
- E. Deficient areas of slab thickness are defined by new cores plotted along with the original cores.
- F. Engineer graphs the deficient areas with the following assumptions:
 - 1. The graph represents the thickness of the pavement.
 - 2. The thickness varies linearly along the pavement's length from core depth to core depth.
 - 3. The pavement is a constant depth in the transverse direction.

1.7 ACCEPTANCE - OVER EXISTING SURFACES

- A. Thickness acceptance of the finished pavement is determined from the graph of the deviations from the profile grade established by the plans or Engineer.
- B. Engineer takes elevations at 100 ft intervals, and compares against the profile and graph to determine deficient thickness areas.
- C. Price adjustments for pavement areas with deviations below thickness profile will be computed using Table 3 in Section 02752 found in Measurement and Payment in the Bid Book.
- D. The Engineer may accept pavement areas with deviations of more than 0.06 ft at 50 percent pay or require removal and replacement. Make all corrections, including removal and replacement, at no additional cost to the Department.

1.8 ACCEPTANCE - COMPRESSIVE STRENGTH (ACCEPTANCE/RETESTING)

- A. Acceptance criteria for compressive strength are detailed in Table 1 of Section 02752 found in Measurement and Payment in the Bid Book.
- B. Hand-placement areas will be considered separately.
- C. The Engineer notifies the Contractor within three calendar days of determining the 28-day compression if any strength test is below specifications. The Contractor may request referee testing in writing within 35 calendar days after placing concrete.
 - 1. An independent third party testing agency will conduct referee testing within 35 calendar days after placement at no additional cost to the Department.
 - 2. All testing laboratories must:
 - a. Be certified by the Cement and Concrete Reference Laboratory.
 - b. Use ACI accredited level one or level two inspectors.
 - c. Be acceptable to both the Department and the Contractor.
 - 3. Obtain six pairs of cores at locations directed by the Engineer. Condition and wet test the cores as specified in AASHTO T 24.
 - 4. Engineer adjusts the core strengths to a standard equivalent cylinder strength by dividing by a factor of 0.85. Each pair of adjusted core strengths will be averaged and considered as a single core test result.
 - 5. Basis of acceptance of the lot will be as follows:
 - a. If any of the adjusted referee core test results are less than 4,000 psi, Engineer uses the lowest core test result or the original cylinder test value, whichever is lowest.

- b. If all the six adjusted referee core test results exceed 4,000 psi and the average is below 4,700 psi, Engineer uses the original cylinder test for the pay factor.
 - c. If all the six adjusted core test results exceed 4,000 psi and the average exceeds 4,700 psi, Department accepts lot at full pay.
- D. Engineer and Contractor jointly determine alternate methods of acceptance for the lot represented by a specimen apparently damaged during the curing process or otherwise unacceptable.
- E. Fill the core holes with concrete after coring making sure that the holes are cleaned and dry at the time they are filled.
 - 1. Coat the sides of the holes with an epoxy resin adhesive from the Performance Data Products Listing (PDPL) maintained by the UDOT Research Division.
 - 2. Consolidate the concrete by rodding or vibrating.
 - 3. Strike off level with the pavement surface, texture, and treat with the specified curing-sealing compound.
 - 4. Protect concrete in core holes from any damage for a minimum of 48 hrs.

PART 2 PRODUCTS

2.1 CONCRETE

- A. Use 3A(AE) concrete.
- B. Refer to Section 03055: Portland Cement Concrete.

2.2 AGGREGATE

- A. Refer to Section 03055 for coarse, fine, and combined aggregates.
- B. Separate and stockpile in two sizes coarse aggregate sizes 2 inch to No. 4 sieve, and 1-1/2 inch to No. 4 sieve with the separation being made on the 1 inch and 3/4 inch respectively.
- C. Use a No. 200 sieve to determine the material size in accordance with AASHTO T 11 and T 27.

2.3 WATER

- A. Use water for washing aggregates, mixing concrete, and at the testing platform that, when compared with distilled water, does not change the setting time of Portland Cement more than 25 percent, or reduce the compressive strength of mortar more than 10 percent.
- B. Limit the maximum concentration of sulfate as SO_4 to 3000 ppm.
- C. Potable water may be used without testing.
- D. Conform to AASHTO T 26.

2.4 ADMIXTURES

- A. Air-entraining Agents
 - 1. Select from the Accepted Products Listing maintained by the UDOT Research Division.
 - 2. When concrete is central-mixed and transported in non-agitating haul units, incorporate synthetic/non-visol resin air entraining admixtures.
 - 3. When central-mixed with agitating haul units or transit mixed, conform to the material standard found in AASHTO M 154.
 - a. Thoroughly mix all entraining agents before use.
 - b. Constantly agitate any agent that settles during batching.

2.5 POZZOLAN

- A. Refer to Section 03055.

2.6 CONCRETE CURING COMPOUND

- A. Refer to Section 03390, Part 2.

2.7 EXPANSION JOINT MATERIALS

- A. Refer to Section 03152, Part 2.

2.8 JOINT SEALERS

- A. Unless specified otherwise, provide pre-approved hot applied joint sealant for transverse-sawed, longitudinal-sawed, and all contact joints following Section 03152.

- B. Select sealers and joint material from the Accepted Products Listing maintained by UDOT Research Division.

2.9 STEEL REINFORCEMENT

- A. Tie Bar: Grade 60, deformed reinforcing steel epoxy-coated following Section 03211.
- B. Dowel Bars: Grade 60, smooth steel rod, epoxy-coated, following Section 03211.

2.10 CONCRETE COLORANT FOR STATION MARKERS

- A. Brick Red 160 or Tile Red A-28 surface, dry-shake type concrete colorant.

2.11 BATCH PLANT

- A. Meet the requirements of the UDOT Quality Management Plan for Ready-Mix Concrete.
- B. Equip batch plant with a numerical printout device that makes a continuous, permanent, and accurate record of:
 - 1. The weights of all individual ingredients including water and cement added after initial batching.
 - 2. The time of day for each batch shown in hours and minutes.
 - 3. Date and daily accumulated totals.
 - 4. Commercial batch plants that are not dedicated to the project are exempt from the daily accumulated total requirement.
- C. Give the Engineer a copy of the record at the end of each production day.
- D. If the printout device malfunctions, finish the shift following the initial malfunction. Then stop operations until the device is fully operational.
- E. Have the beams scales, and water meters on the batching plant checked, certified, and sealed by the Utah Department of Agriculture, Division of Weights and Measures annually and each time the plant or weighing device is moved.

2.12 TESTING PLATFORM

- A. Provide a stable, 40 ft by 8 ft testing platform with a canopy when concrete is hauled in dump trucks.
 - 1. Provide a lockable 8 ft by 10 ft by 8 ft storage room at one end.
 - 2. Locate the platform within 250 ft of the batch plant.
 - 3. Platform height must equal the concrete haul truck bed height.
 - 4. Platform must meet the Department of Labor standards outlined in “Safety and Health Regulations for Construction.”
 - 5. Provide adequate railing, and stairs with a handrail.
 - 6. Provide 110 V electrical power and pressurized water.
 - 7. Maintain suitable lights and outlets and a communication system with the batch plant control room.

2.13 VEHICLES FOR HAULING

- A. Haul vehicles are limited to the legal axle load.
- B. Present certified scale axle weights for each unit in terms of yardage to be hauled.
- C. Permissible to use:
 - 1. End dump trucks with essentially watertight beds and endgates, and rounded corners.
 - 2. Agitator trucks with open tops.
 - 3. Transit mixers that conform to the standard found in AASHTO M 157.
- D. Do not use bottom or belly dump units.

2.14 CYLINDER STORAGE DEVICE

- A. Use a device that maintains a temperature of 60 degrees F to 80 degrees F and is equipped with an automatic 7-day temperature recorder. The recorder's accuracy must be within 2 degrees and have a permanent recording feature.
- B. Use device or devices with the capacity to accommodate the required test cylinders and beams for a minimum of two day's operation. Stop placing concrete if capacity is lacking.
- C. Make the storage devices available on the job site at least 48 hours before placement.
- D. Submit written procedures explaining operation and required monitoring or care of the device for approval.

- E. A 24-hour test run may be required.

2.15 SLIP FORM PAVER

- A. Self-propelled machine with no fluid leaks, equipped with automatic line and grade control capability.
- B. Capable of:
 - 1. Spreading the dumped concrete uniformly across the grade by an auger or a traveling strike-off device.
 - 2. Vibrating, tamping, striking-off, and shaping the concrete to the desired line grade and thickness in one continuous pass.
- C. Under normal operating conditions, do not place wheeled or tracked power equipment in front of the paver redistributing the concrete.
- D. Vibrator minimum requirements:
 - 1. Eccentric Diameter: 1-7/8 inch
 - 2. Frequency: 9500 vibrations per minute minimum.
 - 3. Spacing: 18 inch maximum mounted longitudinally.
- E. Operate the vibrators horizontally at the midpoint of the concrete slab and mounted so they maintain this position.
- F. Run the vibrators parallel to the direction of the paving.
- G. Check each vibrator for operation daily.
 - 1. Shutdown paving operations immediately if any indication of malfunction occurs.
 - 2. Resume operations only after repairing or replacing the vibrator.
- H. Trailing forms: long enough to leave a smooth, straight, vertical edge.
- I. The vibrating and tamping elements: stop when the forward movement of the paver stops.

2.16 FINISHING EQUIPMENT REQUIREMENTS

- A. Machine float that may be attached to the paver.
- B. Burlap drag.

- C. Transverse tining machine (single use) and a comb equipped with steel tines randomly spaced (3/4 in " 1/8 inch).
- D. Curing-sealing compound application machine (single use) with a fully atomizing type power spray and a wind protection hood.
- E. Dual-use tining and curing machine may be used when placement rate is 100 yds³/h or less.

2.17 PAVEMENT SURFACE ROUGHNESS TESTING DEVICE - PROFILOGRAPH

- A. Refer to Section 01452.

PART 3 EXECUTION

3.1 PREPARATION

- A. The profilograph must be on the project site before beginning paving operations.
- B. Aggregate Stockpiles
 - 1. Prepare site by clearing, grubbing, smoothing, and compacting.
 - 2. Construct stockpile platforms to prevent intrusion of subgrade materials into aggregates.
 - 3. Provide adequate drainage for the stockpile site.
 - 4. Construct either individual stockpiles containing materials for a single day of paving, or elongated stockpiles (maximum 25 ft in height, 30 ft top width) with material identified.
 - a. Build stockpiles a minimum of two working days before use.
 - b. Acceptance of stockpiles is in daily increments only and a maximum of 30 calendar days before use.
 - c. May construct standby stockpiles to prevent or avoid delays. Cover until needed.
 - 5. Construct by distributing over entire base in layers not to exceed 5 ft.
 - a. Do not dump or spill over sides.
 - b. Equip conveyors with rock ladder or tremie.
 - c. Maximum drop from rock ladder or tremie is 10 ft.
 - 6. Restrict conical piles to a 10 ft maximum height before distribution.
 - 7. Supply loader and operator to assist in sampling for testing.

3.2 APPLICATION - FORMED PAVING OPTION

- A. Construct pavement between metal side forms conforming to the guidelines in this Section.
- B. Do not allow springing to occur under the weight of paving and finishing equipment.
- C. Forms:
 - 1. Keep free from warps, bends, kinks, and keep equal in depth to the specified pavement edge.
 - 2. Maintain deviation of the forms within 1/8 in from a plane in the top surface or within 1/4 in from a plane surface on the inside face.
 - 3. Set at a distance equal to a day's maximum run.
 - 4. Firmly stake side forms using steel dowels placed on each side of every joint, and spaced not more than 5 ft apart.
 - 5. Tightly join form sections by an interlocking joint free of vertical and horizontal movement.
 - 6. Stop paving operation if the side forms do not meet line and grade, or if side forms are loose.
 - 7. Keep side forms in place for at least 12 hours after the concrete has been placed. Clean and oil forms after each use.
 - 8. Remove the side forms without damage to the edge of the pavement. Immediately fill any honeycomb areas at once with mortar composed of 1 part Portland Cement, 2 parts sand, and sufficient water to form a thick paste.
 - 9. Protect the edges of the pavement with curing-sealing compound after the form removal.
- D. Vibrators:
 - 1. Attach vibrators to the concrete finishing machine in front of the strikeoff auger and mount as transverse moving or longitudinal fixed at 18 inch maximum spacing to clear tie bars.
 - 2. Vibrator minimum requirements:
 - a. Eccentric Diameter: 1-7/8 inch.
 - b. Frequency: 9500 vibrations per minute.
 - 3. Use hand-operated vibrators on a regular pattern not to exceed 12 inches in each direction for irregular areas where required.

3.3 LINE AND GRADE CONTROL

- A. Establish the necessary stakes for grade control over existing surfaces, and provide the elevation control benchmarks.
- B. Use previously established stakes for grade control on the underlying course or courses of lean concrete or asphalt base course.
- C. Equip machinery with a control system which automatically controls concrete placement to the specified longitudinal grades.
- D. Control systems:
 - 1. Must be automatically actuated from an independent line and grade control reference using a system of mechanical sensors or sensor-directed devices.
 - 2. Use sensors that maintain the equipment at the proper transverse slope and elevation to obtain the required thickness and surface.
 - 3. Furnish, place, and maintain supports, wire devices, and materials as required to provide continuous line and grade reference controls for the placing machine, etc.

3.4 BATCHING MATERIALS

- A. As specified for weighing and batching materials. Conform to AASHTO M 157.
- B. Batch mixer: Conform to the standard, and operate at the drum speed recommended by the manufacturer.
 - 1. Do not lose bulk cement and fly ash when transporting into the mixer.
 - 2. Introduce cement before fly ash.
 - 3. Add admixtures to the mix water separately and at different times.
 - 4. Conduct mixing efficiency tests at the beginning of placing concrete, and evaluate as specified in AASHTO M 157, Annex A-1.
 - 5. Maintain a mixing time of 80 seconds at manufacturer recommended mixing speed after all materials are in the drum. If necessary, increase mixing time in 10 second increments until the mixer efficiency evaluation is passed.
 - 6. Correct poor mixing efficiency at no additional cost to the Department.
 - 7. Replace mixing blades when they are worn down 1 inch or more below the original height.
 - 8. Do not allow buildup of cement or mortar on the mixer drums and blades.

- C. Centrally mixed materials:
 - 1. Base mixing time on the results of the mixer efficiency evaluation, and do not mix less than 80 seconds.
 - 2. Mix materials for a minimum of 30 seconds after the last addition of water or cement is made after initial batching.
- D. Transit mixed materials:
 - 1. Add a minimum of 30 revolutions at mixing speed when water is introduced after initial batching. Follow AASHTO M 157.
 - 2. Do not add water to retemper the concrete.
 - 3. Do not add water to the mix after acceptance testing.

3.5 PLACING CONCRETE

- A. Keep the base surface moistened 500 ft in front of the paver without allowing areas of standing water to occur.
- B. Place material according to Section 01452, Part 3, article, "Testing Portland Cement Concrete Pavement" and Section 02752 of Measurement and Payment, "Price Reductions for Deficient Thickness," in the Bid Book.
- C. Place the concrete to the full width of the pavement in a single operation.
- D. Vibrate, screed, and mechanically tamp the spread concrete.
- E. Discharge and place the mixed concrete with a lay down machine within the time frame listed below after introducing the mixing water to the cement and aggregates. Reject concrete not placed within the following time period.
 - 1. Non-agitating Haul Equipment: 35 minutes.
 - 2. Agitating Haul Equipment: 75 minutes.
- F. Deposit the concrete so rehandling is not required.
- G. Thoroughly vibrate against and along the faces of the forms.
- H. Use shovels or other approved tools for any necessary hand spreading. Do not use rakes.
- I. Do not add water to the pavement surface behind the final screed on the paver.
- J. Spray water directly on the final burlap drag only in the quantity necessary to keep the burlap wet.

- K. Do not add water to the surface for finishing. If water is added, paving operations may be shut down or the concrete rejected.
- L. Concrete may be placed in an adjoining longitudinal section three days after initial placement.
- M. Provide protection for initial surface.

3.6 HANDLING AND PLACING REINFORCING STEEL

- A. Properly store all steel received.
- B. Keep tie bars clean, free from damage, and free from distortion.
- C. Place tie bars in the middle third of the slab, as shown on the plans.
 - 1. Refer to Standard Drawings PV 4 and PV 5.
 - 2. Place normal to direction of paving and parallel to the slab surface.
 - 3. Hold tie bars, as shown in the plans.
 - 4. Place by using automatic bar inserters, support on chairs, through forms, or drilled and epoxied in. Manual insertion is not permitted.
- D. When load transfer dowel bars are required, place bars in the middle third of the slab depth, parallel to the centerline and surface of the slab. Limit deviations from parallel to 1/4 inch in the length of the dowel bar.

3.7 FINISHING

- A. Finish the surface smooth and true to grade by machine float immediately after placing concrete. Finish at a rate equal to the progress of the paving operation.
- B. If preliminary finishing is delayed more than 30 minutes after initial screeding, shut down the mixing operation until the situation is resolved.
- C. Texture the pavement by burlap drag and transverse tining.
 - 1. Use at least three plies of wet burlap and drag parallel to the centerline without tearing.
 - 2. Complete the drag finish with one pass.
 - 3. Form depressions in the plastic concrete surface with the tining comb:
 - a. Randomly spaced (3/4 inch " 1/8 inch).
 - b. 3/32 inch to 5/32 inch in deep normal to centerline.
 - c. Do not tear or remove excess mortar in the tining process.
 - 4. Do not tine Category 5 highways as defined in Table 3 in Section 01452.

- D. Mark station numbers every 500 ft and date of placement 25 ft from start and finish of a day's placement on the outside edge of the concrete pavement:
 - 1. After texturing and before curing-sealing.
 - 2. Use a "brand" with changeable numbers a minimum of 3 inches high.
 - 3. Smooth an area approximately 9 inch by 18 inch with a float, color with concrete colorant, and press the "brand" approximately 1/4 inch into the concrete to form the appropriate station number.

3.8 CURING

- A. Refer to Section 03390, Part 3.

3.9 FIELD QUALITY CONTROL

- A. Engineer random samples all concrete.
- B. Compliance with the mix design is determined by inspecting the batching procedures.
 - 1. The Department furnishes the molds and machines for testing.
 - 2. Furnish material, internal vibrators and storage devices following this Section, Part 2, article, "Cylinder Storage Device" for making and curing the test specimens as per AASHTO T 23.
 - 3. Maintain cylinders at a temperature range of 60 degrees F to 80 degrees F for the initial curing period of not less than 24 hours.
 - 4. Cure concrete cylinders and flexure beams in the field a minimum of 24 hours before moving.
 - 5. Maintain storage devices.
- C. Engineer samples materials centrally mixed with non-agitating haul units at the batch plant platform in accordance with AASHTO T 141.
 - 1. One set of strength tests represents 2650 yds² of pavement.
 - 2. Hand-placed areas are considered separately for strength and thickness.
 - 3. Run each truckload of concrete past the platform for inspection. The Engineer may test any or all truckloads.
 - 4. Perform correlation testing to determine the loss of entrained air from the platform to the finished in-place pavement.
 - a. Perform air test on concrete at the platform, and again from the same load in the finished pavement. Record any change in the air content.
 - b. Make necessary adjustments at the platform to achieve adequate air-entrainment in the finished pavement.
 - c. Perform two tests, one in the morning and one in the afternoon, for each day of paving operations.

- D. Engineer samples and tests materials centrally mixed with agitating haul units or transit mixed at placement location. One set of strength tests represents 725 yds² of pavement or one day's placement whichever is smaller (a lot).
- E. Engineer tests air and slump in accordance with AASHTO T 152, and T 119 on the first three loads at startup and after any shutdown of more than one hour.
 - 1. Slow the batching operation to allow completion of each air and slump test before the next batch is made. Communicate test results to the batch plant operator and make necessary corrections.
 - 2. Engineer takes random samples during the day. Any samples taken that differ from air or slump test requirements require the testing and acceptance of three consecutive loads before full operation resumes.
 - 3. Engineer verifies samples that are out of specifications by conducting an additional test on the same load. When the second test is within specifications, Engineer conducts a third test as the deciding factor.
- F. Yield tests: Engineer takes in conjunction with an air test at least one per day in accordance with AASHTO T 121.
- G. Compressive Strength: Engineer conducts a strength test consisting of one set of three cylinders made at the platform or point of placement. Conform to AASHTO T 23.
- H. Flexural Strength: Engineer casts two beams for each day concrete is placed.
 - 1. Conform to AASHTO T 23 and T 97.
 - 2. Beams used to determine when a pavement can be opened for traffic shall be cured in the field at the site of the represented pavement.

3.10 PROTECTION

- A. Protect pavement against all damage and marring.
- B. Keep Contractor hauling equipment and traffic off the pavement until at least ten days after concrete placement as per AASHTO T 97, or until 100 percent of the minimum flexural strength has been achieved.
 - 1. Use barricades to prevent traffic from using the pavement.
 - 2. Construct crossings to bridge the concrete as approved by the Engineer when necessary at no additional cost to the Department.
- C. Protect from rain and hail damage.
 - 1. Cease operation when rain is threatening.
 - 2. Remove, replace, or repair any pavement damaged by rain or hail as directed at no additional cost to the Department.

3.11 JOINTS

- A. Construct contact joints, sawed joints, or transverse expansion joints as shown on the plans.
- B. Keep the faces of all joints at right angles to the top surface of the pavement with all longitudinal joints parallel to the centerline and coinciding with the traffic lane lines.
- C. Place fresh concrete against previously cured concrete at planned locations to form contact joints.
 - 1. When used, retain transverse contact joint forms in place until paving operations resume.
 - 2. Join concrete on both sides of all longitudinal and transverse contact joints with tie bars as shown in contract plans.
 - 3. Maintain the tie bars in their proper position during concrete placement.
 - 4. Saw and seal all contact joints to the dimensions shown on the plans.
- D. Longitudinal contact joints:
 - 1. Construct with tie bars to the dimensions shown on the plans.
 - 2. Do not allow the finished surface across longitudinal contact joints to deviate from a straight line by more than 1/8 inch in 10 ft when tested with a straight edge.
 - 3. Shut down operations until specified tolerances are achieved if the edge slump requirements are not satisfied within 200 ft longitudinally of the start of a contact joint.
 - 4. If the edge slump exceeds the specified 1/8 inch in 10 ft, repair the edge by the following procedures before placing adjacent concrete:
 - a. Saw off the slumped edge to the full thickness with a diamond saw.
 - b. Drill holes in the sawed edge and epoxy in new tie bars.
 - c. Use No. 8 by 24 inch epoxy-coated tie bars. Place midpoint in the slab at 12 inches on center embedded 12 inches into the slab.
 - 5. Straighten bent tie bars and re-coat with epoxy paint at the bend point before placing concrete in the adjacent lane.
- E. Use power driven saws to construct sawed joints. Maintain a minimum of two working power saws and one working standby power saw during concreting operations.
 - 1. Single cut all transverse and longitudinal joints (1/8 inch wide) to one third the depth of the design pavement thickness (T/3).
 - 2. Saw initial or "control" transverse contraction joints at 50 ft intervals or less to control cracking.
 - a. Begin sawing immediately after the concrete has sufficiently hardened and before uncontrolled cracking occurs.

- b. Conduct continuous sawing operations during both day and night regardless of weather conditions.
 - c. Provide lighting during nighttime sawing.
 - 3. Immediately flush all joints with water after sawing and wash cuttings from road surface.
 - 4. Thoroughly clean joints of all loose debris, cement powder, etc., with a jet of water at 2000 psi minimum pressure.
 - 5. Keep the transverse joints clean and dry before placing moisture resistant backer rod and/or sealant.
 - a. Clean the joint with air at a minimum of 100 psi just before placing the backer rod.
 - b. Equip air compressors with operating oil and water traps.
 - 6. Unless specified otherwise, install hot-pour joint sealant (ASTM D 3405) the full depth of the saw cut.
 - 7. Fill the longitudinal joints evenly 1/8 inch " below the pavement surface.
 - 8. Do not permit hauling equipment or traffic on the pavement before all sawed joints are sealed.
 - 9. Match joints in adjacent lanes to form a continuous line across the pavement width including the concrete shoulders.
- F. Make night and transverse contact joints normal to the centerline without keyways on the vertical face.
 - 1. Use No. 10 by 18 inch epoxy-coated tie bars placed midpoint in the slab at 12 inches on center and embedded 9 inches on each side.
 - 2. Form joints with tie bars placed through the form or saw joints with tie bars drilled and epoxied, or as approved.
- G. Form transverse expansion joints at structure approaches as shown on the plans by using a joint filler strip and joint sealer.
 - 1. Firmly support the filler strip by metal holder and end supports which remain in place after completing the pavement.
 - 2. Secure the metal holder and end supports to prevent movement of the filler strip away from the position indicated on the plans when placing and vibrating the concrete.
 - 3. Extend the joint filler the full width of the concrete being placed less 1/4 inch on each end.
 - 4. Remove any concrete which flows around the ends of the joint filler.

3.12 DEFECTIVE PAVEMENT PANELS

- A. A panel is that area of pavement within the traffic lane bounded by two transverse joints.
- B. Engineer determines defective panels within 21 calendar days after placement.

- C. Repair or replace defective pavement panels before acceptance for smoothness at no additional cost to the Department.
- D. Remove and replace panels within the traffic lane when multiple full depth cracks separate the panel into three or more parts including the adjacent shoulder.
- E. Remove and replace portions of panels within the traffic lane and the adjacent shoulder with any full depth transverse crack within 4 ft or less of a transverse sawed joint. Use methods which do not disturb adjacent panels.
- F. Drill and epoxy tie bars as well as dowel bars into existing pavement. Coat dowel bars with a release agent on the free end.
- G. Groove to a 1 inch depth by 3/8 inch width and seal any random full depth cracks that open 1/64 inch or more at the surface in 21 calendar days after placement. Silicone sealant required.
- H. Leave tight random cracks less than 1/64 inch wide undisturbed.
- I. Any core taken for determining full-depth crack is at no additional cost to the Department when the core verifies full-depth cracking.

3.13 SMOOTHNESS TESTING

- A. Determine pavement lane smoothness factors using a profilograph
- B. Refer to Section 01452 for smoothness requirements.

END OF SECTION

Change One - August 29, 2002

No changes made

Change Two - December 19, 2002

No changes made

Change Three - February 27, 2003

No changes made

Change Four - April 24, 2003

Revised Article

1.8 E 1

SECTION 02753

FULL DEPTH SLAB REPLACEMENT FOR CONCRETE PAVEMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Remove panel or partial panel full depth of existing pavement.
- B. Clean, grade and reconsolidate base.
- C. Install dowels and/or tie bars.
- D. Furnish and replace repair material, and cure repair material.

1.2 REFERENCES

- A. American Concrete Institute (ACI) 309: Guide for Consolidation of Concrete.

1.3 RELATED SECTIONS

- A. Section 02752: Portland Cement Concrete Pavement.
- B. Section 03055: Portland Cement Concrete.
- C. Section 03152: Concrete Joint Control.
- D. Section 03310: Structural Concrete.
- E. Section 03390: Concrete Curing

PART 2 PRODUCTS

2.1 FULL DEPTH CONCRETE PAVEMENT REPAIR MATERIAL

- A. Follow Section 02752, Part 2, except that it is acceptable to the use High Range Water Reducers. (Super Plasticizers).
- B. Provide concrete mix design for verification following Section 02752.
- C. Contractor may accelerate the rate of concrete strength gain to match the field placement schedule with written permission from the Engineer.

PART 3 EXECUTION

3.1 PREPARATION

- A. Remove panel, panels, or panel section.
 - 1. Determine the extent/dimensions of the repair from the plan sheets, or as directed by the Engineer. Adhere to the requirements of Standard Drawing PV 4.
 - 2. Complete removal, make full depth cuts around the perimeter of the rectangular section to be removed. Minimize saw over cuts.
 - 3. Remove panels by lift-out method. Use chains and lift pins to facilitate removal and minimize disturbance of the base material.
 - 4. Repair damage caused by the Contractor's operations to adjacent slabs and underlying base courses.
 - 5. Remove all loose particles of old Portland Cement Concrete (PCC) prior to placing new PCC.
- B. Reconstruct base to grade, and compact to standard specifications.
- C. Form any side that does not have an adjacent panel. Form to match existing panels, providing a vertical edge.
- D. Place dowel and/or tie bars.
 - 1. Place bars in locations as per Standard Drawings PV 1, PV 3, PV 4, and PV 5. Use tie-bars or smooth dowels where indicated on standard drawings.
 - 2. Stockpile bars in an area where they are kept clean and free from damage.

3. Drill holes mid-depth of the slab without causing damage to the remaining pavement section and orient holes such that bar placement tolerances can be met. Use gang drills, unless otherwise approved by the Engineer.
 4. Clean holes of dust, grease and other contaminants.
 5. Inject epoxy gel, Type II bonding compound into the back of the drilled hole.
 - a. Select from the Performance Data Products Listing (PDPL) maintained by the UDOT Research Division.
 - b. Provide sufficient quantity of bonding compound to completely fill the void between the bar and the outer limits of the drilled hole.
 - c. Use retention rings to prevent the bonding compound from flowing out of the hole.
 6. Align bars horizontally and vertically to meet requirements of the standard drawings.
 7. Repair any bar coating damage with appropriate repair material.
 8. Coat protruding portion of dowel bar with lubricant consisting of paraffin wax, lithium grease or other semi-solid, inert lubricant approved by the Engineer.
 9. Set bonding compound and stabilize bar prior to mix placement. Remove and replace loose bars, at the Contractor's expense, prior to placing concrete mix.
- E. Prepare existing joints for placement.
1. Maintain existing pavement joint layout.
 2. Place a bond breaker approved by the Engineer, on the existing pavement edges that compose existing joints, either transverse or horizontal.
 3. Saw joint on the same line if repairs straddle an existing joint line. Perform sawing in accordance with Section 03390.

3.2 PLACING CONCRETE

- A. Place concrete in compliance with Section 03310, Part 3, article, Placing Concrete.”
- B. Consolidate the mix with a mechanical vibrator in accordance with ACI 309 guidelines. Do not over-consolidate. Do not use hand vibrators to move mix.
- C. Discard any unused mix after 30 minutes from the time mixing was completed for accelerated strength gain rate mix designs. Place normal mixes in accordance with Section 03055, Part 3, article, “Limitations - General,” paragraphs A through B.
- D. Weather Limitations - Place, cure and protect in accordance with Section 02752, Part 1, article, “Project Conditions/Limitations.”

3.3 CONCRETE FINISHING

- A. Finish patch to +/- 1/8 inch of existing profile.
 - 1. Correct patch profiles in excess of 1/8 inch higher than the existing pavement profile through surface grinding or removal and replacement.
 - 2. Correct patch profiles in excess of 1/8 inch lower than the existing pavement profile through removal and replacement of the patch.
 - 3. Contractor pays for any corrections to the finish of the patch.
- B. Do not tool joints that are to be saw-cut and sealed.
- C. Texture the surface to match the existing pavement.

3.4 CURING CONCRETES

- A. Cure the slab surface before it begins to dry with material meeting the requirements of Section 03152. Uniformly spray the surface at a minimum rate of 0.44 gal/yd².
- B. Do not open to traffic until compressive strength tests show that a minimum of 3,000 psi has been reached.
- C. Cut all previously existing joints to original dimensions.
- D. Fill all sawing overcuts with a repair epoxy from the Performance Data Products Listing (PDPL) maintained by the UDOT Research Division.
- E. Replacement slab must perform under traffic at specified time of opening without failure.
- F. Contractor pays for removing and replacing any defective panels. Refer to Section 02752, Part 3, article, "Defective Pavement Panels."

3.5 PROTECTION

- A. Protect the individual placements with approved barricades.

END OF SECTION

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No changes made

Change Two - December 19, 2002
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Change Three - February 27, 2003
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Change Four - April 24, 2003
Revised Articles
 3.1 D 5a
 3.4 D

SECTION 02842

DELINEATORS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Delineators, Type I and Type II.
- B. Culvert and maintenance markers.
- C. Freeway turnaround markers.

1.2 RELATED SECTIONS

- A. Section 02765: Pavement Marking Paint.

1.3 REFERENCES

- A. AASHTO M 111: Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- B. AASHTO M 268: Retroreflective Sheeting for Traffic Control.
- C. ASTM A 570: Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality.
- D. ASTM D 638: Tensile Properties of Plastics.
- E. ASTM G 23: Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials.
- F. Military Specification MIL-M 43719B

PART 2 PRODUCTS

2.1 STEEL POSTS

- A. Supply and galvanize posts as specified. ASTM A 570, Grade C, and AASHTO M 111.
- B. Use flanged, channel-shaped steel posts that weight 2 lbs/ft.
- C. Make all cuts before galvanizing posts. Follow Standard Drawing GW 9.

2.2 FLEXIBLE POSTS

- A. Free of burns, discoloration, contamination, and other defects.
- B. Remains flexible at temperatures from -5 degrees F to +140 degrees F.
- C. Capable of being driven into an earth shoulder with or without a pilot hole.
- D. Tensile strength of 1100 psi. ASTM D 638.

2.3 QUALITY CONTROL - FLEXIBLE POST TESTING

- A. Meet Cold Bend Test:
 - 1. Subject 2 posts to a temperature of -10 degrees F, " 5 degrees F for at least four hours.
 - 2. Immediately bend each post 4 times through a 90 degree angle around a 2 inch mandrel.
 - 3. Each post must return to its original straight configuration within a " 10 degree angle within 5 minutes at the end of the 4 bends.
 - 4. Any cracking or significant loss of rigidity are grounds for failure.
- B. Meet Hot Bend Test:
 - 1. Subject 2 posts to a temperature of 100 degrees F " 5 degrees F for at least 4 hours.
 - 2. Satisfy all bending and physical requirements specified in the Cold Bend Test.
- C. Meet Impact Resistance Test:
 - 1. Subject post to impacts by a typical sedan as follows:
 - a. 3 hits - 0 degree angle at 0 degrees F.
 - b. 3 hits - 0 degree angle at 100 degrees F.

- c. 10 hits - 0 degree angle at 35 mph.
 - d. 5 hits - 15 degree angle at 55 mph.
 - 2. Acceptable results:
 - a. Installed post remain intact, securely anchored and within " 10 degrees of vertical orientation.
 - b. Installed post shows minimal signs of cracking or loss of rigidity.
 - c. Installed post retains at least 50 percent of its reflective sheeting.
 - d. Impact vehicle suffers little or no damage during the impact test.
- D. Exposure:
 - 1. Expose the specimens for 500 hours in a carbon arc-type apparatus following ASTM G 23, Method 1.
 - 2. Acceptable results:
 - a. Exposure does not result in delamination, distress, or discoloration.
 - b. Sheeting is not removable from the specimens without damage.
 - c. Post is resistant to ultraviolet light, ozone, hydrocarbons, and other weathering.

2.4 SHEETING

- A. Select from Accepted Products Listing (APL) maintained by the UDOT Research Division.
- B. Reflective sheeting: Encapsulated lens sheeting or encapsulated lens (flexible) as specified. Standard Specifications for Construction of Road and Bridges on Federal Highway Projects, FP-92, Type III.
- C. Non-reflective sheeting: As specified. Military Specification MIL-M 43719B, Type I, Class I.

2.5 PAINT

- A. Refer to Section 02765.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Posts: visibly free of bends or twists both before and after installation.

END OF SECTION

Change One - August 29, 2002
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Change Two - December 19, 2002
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Change Three - February 27, 2003
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Change Four - April 24, 2003
Revised Article
2.4 A

SECTION 02861

PRECAST RETAINING/NOISE WALLS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Materials and procedures for constructing Precast Retaining/Noise Wall.

1.2 RELATED SECTIONS

- A. Section 01571: Temporary Environmental Controls.
- B. Section 02061: Select Aggregates.
- C. Section 03055: Portland Cement Concrete.
- D. Section 03152: Concrete Joint Control.
- E. Section 03211: Reinforcing Steel and Welded Wire.
- F. Section 03310: Structural Concrete.
- G. Section 03390: Concrete Curing.

1.3 REFERENCES

- A. AASHTO Standard Specifications for Highway Bridges.

1.4 SUBMITTALS

- A. Lifting devices: Submit calculations and shop drawings for approval.
- B. Precast Concrete Panels: Submit for approval samples of the exposed aggregate finish before casting the panels.

1.5 HANDLING, SHIPPING, AND STORAGE

- A. Shipment Acceptance: Panels or posts may be accepted for shipment and marked with an orange UDOT sticker if they:
 - 1. Meet the 28 day compression test.
 - 2. Are cured and sealed according to specification.
 - 3. Are not cracked or damaged.
- B. Do not ship any panel or post that does not satisfy strength requirements.

PART 2 PRODUCTS

2.1 MATERIALS FOR PRECAST NOISE WALLS AND RETAINING WALLS

- A. Precast Wall Panels and Posts:
 - 1. Concrete Class AA(AE). Refer to Section 03055.
 - 2. Type II cement.
 - 3. Slump requirement need not be met.
 - 4. 28 day minimum compressive strength of 5,000 psi.
- B. Post Hole Concrete: Concrete Class B(AE). Refer to Section 03055.
- C. Reinforcing Steel: Coated Grade 60. Refer to Section 03211, part 2.
- D. Welded Wire Fabric: Coated. Refer to Section 03211.
- E. Curing Compound: Type I, Class A. Refer to Section 03390.
- F. Gravel for Post Holes: Free Draining Granular Backfill Borrow. Follow Section 02061, Part 2.
- G. Elastomeric Bearing Pad: 60 hardness. As specified in AASHTO Standard Specifications for Highway Bridges, Division II, Article 18.2.
- H. Backer Rod: Refer to Section 03152.
- I. Construction Adhesive: Select from the Performance Data Products Listing (PDPL) maintained by the UDOT Research Division.
- J. Wood Shims: Any grade fir.

2.2 ADDITIONAL MATERIALS FOR RETAINING WALLS

- A. Composite Drainage Material: Two-layer composite, consisting of non-woven silt fence geotextile and matting surface that are heat bonded together.

1. Polyester non-woven fabric. Follow Section 01571, Part 2, article, "Silt Fence."
2. Compression resistant matting of three-dimensional construction capable of multidirectional flow.

2.3 LIFTING DEVICES

- A. Galvanized flush-type that do not project beyond the edge of the panels.
- B. Capable of lifting the maximum size of panels (11.5 ft x 7 ft x 5 inches) and of tilting them from horizontal position to vertical position.
- C. Shear factor of safety of 2.66:1 for lifting from a flat position and a tension factor of safety of 4:1 for lifting from a vertical position.
 - D. Designed for shear so that the panels can be lifted from either side.
 - E. Provide a sealing cover.

2.4 CONCRETE POSTS

- A. Cast posts in metal forms.
- B. Permanently mark each post with date of casting and post the identification number supplied by the inspector. Place markings in fresh concrete in the portion of the post that will be embedded in soil.
- C. Department accepts posts if they:
 1. Meet the 28 day compressive strength.
 2. Are cured and sealed according to specification.
 3. Have been visually inspected and accepted by the Engineer.
 4. Have sides that do not deviate from a straight line by more than 3/8 inch per post height.
- D. Replace posts that are:
 1. Cracked or damaged.
 2. Not permanently marked.

2.5 PRECAST CONCRETE PANELS

- A. Fabricator will be pre-qualified as a supplier of pre-cast concrete products in accordance with the Quality Management Plan.
 - B. Cast the panels to required tolerances regarding all dimensions.
 - 1. Cast in metal forms.
 - 2. Do not use coloring additives.
 - 3. Make panels match in contrast.
- C. Permanently stamp panel identification number supplied by Engineer in the top surface of one lifting device prior to casting.
- D. Expose the aggregate on both sides. Remove all residue from exposed surfaces.
- E. Department accepts panels when they:
 - 1. Meet the 28 day compressive strength.
 - 2. Are cured and sealed according to specification.
 - 3. Have been visually inspected and accepted by the Engineer.
 - 4. Have sides that do not deviate from a straight line by more than 1/8 inch.
- F. Replace panels that:
 - 1. Are cracked or damaged.
 - 2. Do not match in contrast.
 - 3. Are not permanently marked.

PART 3 EXECUTION

3.1 LIMITATIONS

- A. Refer to Section 03055 for hot and cold weather limitations.

3.2 CURING

- A. Refer to Section 03390.

3.3 POST HOLES

- A. Refer to Standard Drawings SW 3B and SW 4B.
- B. Place edge of post holes no nearer than 2 ft from any underground utility.

3.4 LIFTING DEVICES

- A. Place waterproof caps in the lifting devices after the panels are permanently placed.

3.5 CONCRETE POSTS

- A. Set true to line and grade. Reject and replace posts more than 1/2 inch out of plumb in exposed length.
- B. Replace posts that do not adequately support or accept insertion of the precast panels.
- C. Replace cracked or damaged posts.
- D. Glue elastomeric bearing pads to the concrete post for Precast Retaining/Noise Wall, following the manufacturer's recommendations.

3.6 PRECAST CONCRETE PANEL PLACEMENT

- A. Set elevations in the field for Engineer's acceptance. Stake elevations to the bottom of the bottom panel. Align as shown on the plans.
- B. Place the panels in the posts with the form side facing the highway.

3.7 RETAINING WALLS

- A. Follow Standard Drawings SW 6, SW 7.
- B. Composite drainage material:
 - 1. Place behind the wall panels at each weep hole location.
 - 2. Place the fabric side of the material against the fill. Extend the length of the material from the bottom of the wall panel to the top of the fill.
- C. Filter Fabric: Place around the back side of the posts as shown in the plans. Extend the material from the bottom of the wall panel to the top of the fill.

- D. Free Draining Granular Backfill Borrow: Place and tamp down behind the wall panels, between the posts to the fill height and length, and at the locations shown on the plans.

END OF SECTION

Change One
No changes made

Change Two - December 19, 2002
Revised Article
3.5 D

Change Three - February 27, 2003
No changes made

Change Four - April 24, 2003
Revised Article
2.1 I

SECTION 02911

MULCH

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Types of mulch and application requirements.

1.2 RELATED WORK

- A. 02922: Seed, Turf Seed, and Turf Sod.

1.3 REFERENCES

- A. TxDOT/TTI Hydraulics and Erosion Control Laboratory Field Performance Testing of Selected Erosion Control Products.
- B. Erosion Control Pilot Study - Caltrans Document No. CTSW-RT-00-012.

1.4 SUBMITTALS

- A. The manufacturer's specifications and recommended installation requirements.
- B. If straw mulch is required, submit a certificate from the Utah Department of Agriculture indicating the straw has been obtained from a weed-free field.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in original wrapping showing the name of the manufacturer and product description.

PART 2 PRODUCTS

2.1 WOOD FIBER MULCHES

- A. Contact UDOT's Region Landscape Architect for Approved List of Wood Fiber Mulches. Approved list is updated annually.

2.2 STRAW MULCH

- A. Clean, cereal straw from a field certified by the Utah Department of Agriculture as weed-free and noxious weed-free.
- B. Air dried with a maximum moisture content of 18 percent.

2.3 TACKIFIER A

- A. A dry powder mixture of three hydrocolloids from natural plant sources, which has been combined with a crosslinking agent.
- B. Will hydrate when incorporated in a water slurry, and resist rewetting when dry on the soil surface, but allow moisture penetration into the soil.
- C. Viability of 6 to 9 months.
- D. Biodegradable and nontoxic to animal and plant life.

2.4 TACKIFIER B

- A. A dry powder produced from grinding the outer coating (psyllium) of the seed collected from the plant, insular plantago.
- B. Will hydrate when incorporated in a water slurry and forms a firm, resilient, rewettable membrane on the soil surface.
- C. Organic, non-toxic, and safe for animals and plants.

PART 3 EXECUTION

3.1 PREPARATION

- A. Complete all required grading and seeding before applying mulch.
- B. Apply the mulch within 24 hours after seeding or before precipitation falls. If the mulch is not installed and a precipitation event occurs creating soil erosion, replace eroded material, rework the soil, and reseed before applying the mulch.

3.2 APPLYING MULCH

A. Wood Fiber Mulch

1. Apply wood fiber mulch, tackifier A or B, and water at the following rates per acre:
 - a. Mulch: 2,000 lbs
 - b. Tackifier A: 40 lbs
Tackifier B: 150 lbs
 - c. Water: 5,000 gal
2. Mix water, tackifier, and wood fiber mulch in a hydroseeder, following manufacturer's directions.
3. Apply mulch to form an even cover over the seeded areas.
4. On cut slopes, extend the mulch over the top of the slope to cover all disturbed areas.

B. Straw Mulch

1. Apply 2,500 lbs of straw (having moisture content less than 18 percent) per acre.
2. Apply straw uniformly using a blower-type mulching machine.
3. Begin application at the top of the slope working in a downward direction.
4. On cut slopes, extend straw mulch over the top of the slope and tie in to existing vegetation.

C. Straw Anchoring

1. Demonstrate and obtain approval of the crimping procedure from the Engineer.
2. On accessible slopes, crimp the straw into the soil using a sheep's foot roller, a dull edged disk-type roller or other approved equipment that will anchor the straw into the soil without slicing the straw. Apply water to compacted or dry soils before crimping.
3. On slopes inaccessible to crimping equipment, inject a tackifier at the rate indicated above into the straw as it leaves the blower or apply a tackifier after straw is placed using a hydromulcher. Mix tackifier at rate indicated above, 5,000 gallons of water and 250 lbs of wood fiber mulch per acre.

END OF SECTION

Change One - August 29, 2002
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Change Three - February 27, 2003
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Change Four - April 24, 2003
Revised Article
3.2 A1

SECTION 02931

POLE PLANTINGS/WILLOW CUTTINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Collecting and installing pole plantings and/or willow cuttings.

1.2 REFERENCES

- A. ANSI A-300: Pruning Standards.
- B. International Society of Arboriculture: Current standards for pruning.

1.3 SCHEDULING

- A. Install poles and cuttings in the fall after October 15 and before the ground becomes frozen or in the spring after the ground thaws and before April 15.

PART 2 PRODUCTS

2.1 POLES AND CUTTINGS

- A. Collect poles and cuttings from live native stands of the species listed from October 15 to February 15.
- B. Obtain poles and cuttings from live trees and shrubs that will be destroyed due to highway construction, from areas adjacent to the project or from locations that are ecologically matched in climate and elevation.
- C. Before collecting poles and cuttings outside the right-of-way, obtain necessary permits from appropriate regulatory agency or permission from land owner.
- D. When collecting poles and cuttings from trees or shrubs that will remain, prune branches using current standards from the International Society of Arboriculture.

- E. When obtaining poles and cuttings from vegetation that will remain within the right-of-way, remove no more than 1/3 of the branches from any tree or shrub.
- F. Size of poles and cuttings, as determined by the Engineer:
 - 1. Pole: Cut branches at a 45 degree angle, 6 ft long and 1 inch to 3 inches in diameter from one to three-year-old growth.
 - 2. Willow Cutting: Cut stems at a 45 degree angle, 3 ft long and 3/8 to 3/4 inch in diameter from one to two-year-old growth.

PART 3 EXECUTION

3.1 STORING

- A. If dormant poles and cuttings are acquired but not planted in the fall, store until the ground thaws.
- B. Store in plastic bags at temperatures between 32 degrees F to 41 degrees F, or outside in snow-filled plastic bags.
- C. Do not allow the poles or cuttings to dry out or break bud while being stored.

3.2 INSTALLING

- A. Stake poles and cuttings at plan locations for approval or as directed.
- B. Dig a hole deep enough to accommodate 90 percent of the length of the cutting.
- C. Just before planting, remove 1 inch from the basal end of the pole or cutting.
- D. Place the pole or cutting in the hole (basal end first).
- E. Backfill and compact around the pole or cutting to eliminate air pockets.
- F. Water the pole or cutting and add more backfill if settling occurs.

END OF SECTION

Change One - August 29, 2002
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Change Three - February 27, 2003
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Change Four - April 24, 2003
Revised Articles
3.2 B

SECTION 03392

PENETRATING CONCRETE SEALER

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Materials and procedures for applying protective penetrating concrete sealer.

1.2 REFERENCES

- A. AASHTO T 260: Sampling and Testing for Total Chloride Ion in Concrete and Concrete Raw Materials.
- B. ASTM C 267: Chemical Resistance of Mortars, Grouts, and Monolithic Surfacing and Polymer Concretes.
- C. ASTM C 666: Resistance of Concrete to Rapid Freezing and Thawing.
- D. ASTM E 274: Skid Resistance of Paved Surfaces Using a Full-Scale Tire.

1.3 SUBMITTALS

- A. Certificate of Compliance to the Engineer or the Construction and Materials Division.
- B. One quart of the product to the Engineer.

PART 2 PRODUCTS

2.1 PENETRATING CONCRETE SEALERS

- A. Choose from the following list:
 - 1. Silane
 - 2. Siloxane
 - 3. Silicate
 - 4. Siliconate

5. Organo Silane Ester
6. Styrene Acrylic Copolymer
7. Organo Siloxane
8. Alkylalkoxy Siloxane
9. Alkylalkoxy Silane

B. Comply with requirements of Table 1:

Table 1

Penetrating Concrete Sealer Requirements				
* Properties	Requirements	ASTM	AASHTO	** UDOT
Accelerated Weathering	As Specified	C 666	T 260	
Freeze-thaw Test Medium	Less than or equal to 3 percent Road Salt			Sealer Studies
Minimum Depth Penetration	Greater than or equal to 3/16 inches			Sealer Studies
Freeze-thaw Weight Loss	Less than or equal to 6 percent 300 Cycles			Sealer Studies
Chemical Resistance	Subsections: 1.1.2 1/1/3	C 267		
Friction Number	Greater than or equal to 40	E 274		
Infrared Spectrogram	Materials Division Base Comparison			Materials Studies

* Certified test results from a private accredited testing laboratory will suffice for acceptance.

** Utah Department of Transportation, Materials and Research Division concrete sealer studies of 1986 and 1990.

PART 3 EXECUTION

3.1 PREPARATION

- A. Keep surfaces dry and free of laitance, dirt, dust, paint, grease, oil, rust, and other contaminants.
- B. Remove any curing compound from the surface of the concrete before applying penetrating sealer.
- C. Use one of the following cleaning methods:
 - 1. Hydroblasting - 700 psi min.
 - 2. Shotblasting
 - 3. Sandblasting
 - 4. Etching
- D. Keep concrete surface matrix intact without exposing any large aggregate.
- E. Cure concrete for 28 days prior to sealer application.
- F. Place the material after obtaining the approval from the Engineer.

3.2 APPLICATION

- A. Application Rate:
 - 1. Based upon the residue content at a coverage rate of 0.11 lbs/yd².
 - 2. Apply according to manufacturers recommendation for each of the following surfaces:
 - a. Horizontal
 - b. Vertical
 - c. Overhead
- B. Application Drying Time: Select a sealer with maximum drying time of 1½ hours.
- C. Upon application, meet the minimum Friction Number of 40 for at least 90 percent of friction numbers.

END OF SECTION

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2.1 A 8-9

SECTION 03921

PARAPET SURFACE REPAIR AND SEALING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Repair and seal existing concrete front face and top of parapets.

1.2 RELATED SECTIONS

- A. Section 03310: Structural Concrete.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Patching Concrete:
 - 1. Select from the Performance Data Products Listing (PDPL) maintained by the UDOT Research Division.
 - 2. Only use products for which vertical application is recommended by the manufacturer.
- B. Substrate Coating: Bonding agent or primer recommended by the patching concrete manufacturer.
- C. Surface Sealing Material (Penetrating Type): Select from the Accepted Products Listing (APL) maintained by the UDOT Research Division.

PART 3 EXECUTION

3.1 PREPARATION

- A. For Surface Repair:
 - 1. Remove loose and spalled concrete before sandblasting.

2. Sandblast the top and traffic face of the concrete surfaces to remove all dirt, grease, laitance, rust and corrosion prior to placing concrete.
- B. For Sealing:
1. Sandblast the top and traffic face of the parapet surfaces to remove all dirt, grease, and laitance.
 2. Patch spalled or damaged spots on parapets before applying sealer.

3.2 SURFACE REPAIR

- A. Prevent sandblasting material and debris from falling into streams, pedestrian areas, traffic areas, or onto railroad tracks.
- B. After sandblasting, coat concrete substrate with the manufacturer's recommended primer of the particular patching concrete.
- C. Place concrete within the manufacturer's prescribed time period after sandblasting and prime coating has been completed.
- D. Patching Concrete:
1. Apply the one component, non-shrinking patching concrete uniformly to build back the original surfaces of the face and top areas of the parapets to within $\pm 1/8$ inch of the original surface. Allow concrete to cure in accordance with the requirements of the manufacturer's recommendation.
 2. If the patch fails to bond to the existing concrete, remove the patch completely and repair again.
- E. Finishing Surfaces:
1. Provide a uniform color matching existing parapet.
 2. Finish according to Section 03310, part 3, article, "Concrete Surface Finishing." Follow manufacturer's recommendations for procedure.
- F. Coating Parapet Surfaces:
1. Allow concrete to properly cure.
 2. Sandblast all curing compound from the top and traffic face of the parapet.
 3. Coat all sandblasted surfaces with non-penetrating type epoxy sealer following the manufacturer's recommended procedure.
- G. If wingwalls, overhanging portions of the deck, and/or exterior beam surfaces become stained or discolored due to water or concrete leaking from the forms, provide a satisfactory treatment to restore these surfaces to a uniform color.
- H. Remove sandblasting materials and debris from the deck after the work is complete.

3.3 SEALING

- A. Coat the top and traffic face (front face) with non-penetrating type epoxy sealer, following the manufacturer's application procedures and recommendations.

END OF SECTION

Change One - August 29, 2002

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Change Three - February 27, 2003

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Change Four - April 24, 2003

Revised Articles

2.1 AI

2.1 C

SECTION 03922

DELAMINATION REPAIR

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Repair delaminated concrete areas.

1.2 PAYMENT PROCEDURES

- A. This item is included in other items of work.

1.3 RELATED SECTIONS

- A. Section 03055: Portland Cement Concrete.
- B. Section 03310: Structural Concrete.

1.4 REFERENCES

- A. AASHTO M 235: Epoxy Resin Adhesives.

1.5 ACCEPTANCE

- A. Rebuild the areas to original shape, $\pm 1/8$ inch.
- B. Remove and repair if the patching fails to bond. Department does not allow additional compensation for continual repair.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Repair Concrete:
 - 1. Portland Cement Concrete: Class AA(AE). Refer to Section 03055, Part 2.
 - 2. Cement: Type II. Refer to Section 03055, Part 2.
 - 3. Aggregate: 3/4 inch maximum.
- B. Patching Concrete:
 - 1. Select from the Performance Data Products Listing (PDPL) maintained by the UDOT Research Division.
 - 2. Only use products for which the manufacturer recommends vertical application.
- C. Substrate Coating: Use a bonding agent or primer recommended by the particular patching concrete manufacturer.
- D. Epoxy Resin Adhesive: Type II. AASHTO M 235.
 - 1. Use a class rating consistent with the application temperature.
 - 2. Select from the Performance Data Products Listing (PDPL) maintained by the UDOT Research Division.
- E. Surface Sealing Material (Penetrating Type): Select from the Accepted Products Listing (APL) maintained by the UDOT Research Division.

2.2 MIXER

- A. Use an approved type of small mixer to batch out the repair concrete when specifically approved by the Engineer.

PART 3 EXECUTION

3.1 PREPARATION

- A. Locate the repair areas: Sound the items requiring this work and mark the limits of delaminated areas for repair work in the presence of the Engineer.
- B. Remove concrete:
 - 1. Remove all loose materials by dry sweeping.

2. Clean by blowing with compressed air at 90 psi.
 3. Make ½ inch deep saw cuts in the sound concrete surrounding the damaged areas.
 4. Remove all damaged and shattered concrete.
- C. Cleaning:
1. Remove all loose materials by dry sweeping.
 2. Clean by blowing with compressed air at 90 psi.
 3. Sandblast clean all exposed reinforcing steel and concrete surfaces before placing new concrete.

3.2 INSTALLATION

- A. Form Work
1. Use forms and braces to place new concrete to the original dimensions.
 2. Vibration is required in the forms when the area between forms and existing concrete surface will allow use of vibrators.
- B. Use one type of repair concrete.
- C. Placing concrete when thickness to be placed is less than or equal to 3 inches:
1. Use patching concrete.
 2. Coat the cleaned concrete using the manufacturer's recommended primer.
 3. Place patching concrete in layers not exceeding the manufacturer's recommended application thickness per layer.
 4. Apply the surface sealer recommended by the manufacturer.
 5. Consult the manufacturer's recommendations for finishing.
- D. Placing concrete when thickness to be placed is greater than 3 inches:
1. Apply an epoxy-resin adhesive to the cleaned concrete surface of the repair area before placing the new concrete.
 2. Place the concrete and allow to cure following the requirements of Section 03310, articles, "Concrete Surface Finishing Classifications," "Concrete Surface Finishing," and "Concrete Surface Finishing Procedures."
 3. After the concrete has properly cured, sandblast the finished concrete surfaces and coat with a non-penetrating type epoxy sealer. Follow the manufacturer's procedure.
- E. Finished surfaces: Provide the look of one color.

END OF SECTION

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2.1 B 1

2.1 B 2

2.1 D 2

2.1 E

SECTION 03923

COLUMN SEALING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Clean Concrete and apply sealer to entire column.

PART 2 PRODUCTS

2.1 CONCRETE SEALER

- A. Penetrating type.
- B. Select from the Accepted Products Listing (APL) maintained by the UDOT Research Division.

PART 3 EXECUTION

3.1 APPLICATION

- A. Sandblast the entire exposed column surfaces clean of all dirt, grease, and laitance.
- B. Coat the entire column with the penetrating concrete sealer following the manufacturer's application procedures and recommendations.

END OF SECTION

Change One - August 29, 2002
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Revised Articles
 2.1 A, B
 3.1 B

SECTION 03924

STRUCTURAL CONCRETE REPAIR

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Restore to sound condition:
 - 1. Column
 - 2. Pedestal
 - 3. Bent Cap
 - 4. Pier Cap
 - 5. Diaphragm
 - 6. Wingwall
 - 7. Abutment Backwall
 - 8. Beam End

1.2 RELATED SECTIONS

- A. Section 03922: Delamination Repair
- B. Section 03935: Epoxy Injection and Sealing

PART 2 PRODUCTS

2.1 MATERIALS

- A. Refer to Sections 03922 and 03935.

2.2 BEAM END REPAIR SURFACE SEALING MATERIAL

- A. Penetrating type.
- B. Select from the Accepted Products Listing (APL) maintained by the UDOT Research Division.

PART 3 EXECUTION

3.1 CRACK REPAIR

- A. Repair cracks from 1/64 inch to 1/4 inch wide by epoxy injection and sealing. See Section 03935.
- B. Repair cracks greater than 1/4 inch wide as “delaminated concrete.”

3.2 DELAMINATION REPAIR

- A. Repair delaminated concrete by delamination repair. Refer to Section 03922.
- B. Beam End Delamination Repair: Use a patching concrete.
- C. After concrete removal:
 - 1. Repair any crack found in a delaminated area according to Section 03935.
 - 2. After the injection operation, apply surface sealing after repairing the delaminated area.
- D. When surface sealing after crack injection and delamination repair operations:
 - 1. Use epoxy sealer for surface sealing exclusively.
 - 2. Apply sealer to a minimum beam length of 4 ft covering all surfaces in that beam segment.

END OF SECTION

Change One - August 29, 2002

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2.2 A, B

SECTION 03935

EPOXY INJECTION AND SEALING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Repair concrete cracks by injecting epoxy and sealing the concrete surfaces.

1.2 PAYMENT PROCEDURES

- A. These items are included in other items of work.

1.3 ACCEPTANCE

- A. Penetration of 95 percent of all cracks from 1/64 inch to 1/4 inch wide is required.

1.4 DELIVERY

- A. Deliver the packages materials in unopened packages with labels clearly indicating the following:
 - 1. Name of Manufacturer
 - 2. Manufacturer's product name or product number
 - 3. Manufacturer's lot number
 - 4. Mix ratio
 - 5. SPI Hazardous Material Rating and appropriate warnings for handling

PART 2 PRODUCTS

2.1 MATERIALS

- A. Select from the Performance Data Products Listing (PDPL) maintained by the UDOT Research Division.

1. Epoxy Injection Material:
 - a. Use only products for which vertical crack injection is recommended by the manufacturer.
 - b. Use appropriate cap seal material recommended by the particular epoxy manufacturer.
2. Surface Sealing Material: Penetrating sealer.

2.2 EQUIPMENT

- A. Minimum of two pumps with the following required characteristics:
 1. Electric-powered and portable.
 2. Positive displacement.
 3. Positive-ratio control of exact proportions of the two components at the nozzle.
 4. In-line metering and mixing.
- B. Injection equipment required characteristics:
 1. Automatic pressure control capable of discharging the mixed adhesive at any pre-set pressure up to 200 psi " 0.5 psi.
 2. Equipped with a manual pressure control override.
- C. Capable of maintaining the volume ratio of the injection material prescribed by the manufacturer within a tolerance of " 5 percent by volume at any discharge pressure up to 200 psi.
- D. With sensors on both the component A and B reservoirs that automatically stop the machine when only one component is being pumped to the mixing head.

PART 3 EXECUTION

3.1 INSTALLERS

- A. Injection equipment operators must have a minimum of 2 years experience in the methods and materials of the selected system for application of epoxy injection.
- B. Injection equipment operators must know the technical aspects of:
 1. Correct material selection and use.
 2. Equipment operation, maintenance, and troubleshooting.

3.2 PREPARATION

- A. Sandblast clean the concrete surfaces.
- B. Seal cracks.
- C. Provide entry ports for the epoxy injection. Space ports a maximum of 6 inches.

3.3 EPOXY INJECTION

- A. Proceed from lower to higher ports.
- B. When epoxy appears at a higher port, plug the port being injected and move to a higher port.

3.4 EPOXY SEALING

- A. Grind flush all ports extending above the concrete surfaces.
- B. Apply the sealant at the minimum application rate of 0.09 gal/yd².
- C. Cover the entire length of the crack with epoxy sealant for a minimum of 2 ft on either side of the crack.
- D. Mask the member so a straight vertical line is produced at the cutoff point.
- E. Apply a second coat at the same application rate as soon as the first coat is dry to the touch. Do not exceed the following times between coats:

Hours	Temperature (Degrees F)
72	66
36	77
24	90

END OF SECTION

Change One - August 29, 2002
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2.1 A

2.1 A 2

SECTION 07105

WATERPROOFING MEMBRANE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Prepare an entire concrete deck and the approach slabs, or specified structure joint areas for waterproofing membrane.
- B. Place waterproofing membrane.

1.2 REFERENCES

- A. ASTM C 578: Rigid, Cellular Polystyrene Thermal Insulation.
- B. ASTM D 5: Penetration of Bituminous Materials.
- C. ASTM D 36: Softening Point of Bitumen (Ring-and-Ball Apparatus).
- D. ASTM D 146: Sampling and Testing Bitumen - Saturated Felts and Woven Fabrics for Roofing and Waterproofing.
- E. ASTM D 882: Tensile Properties of Thin Plastic Sheeting.
- F. ASTM D 3236: Apparent Viscosity of Hot Melt Adhesives and Coating Materials.
- G. ASTM E 96: Water Vapor Transmission of Materials.
- H. ASTM E 154: Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
- I. Vermont DOT: Low Temperature Flexibility Test.

1.3 WEATHER LIMITATIONS

- A. Do not work during wet conditions or when the deck or ambient air temperatures are below 50 degrees F.
- B. Do not apply the membrane unless the deck is surface dry.

1.4 SCHEDULING

- A. Notify the Engineer at least 1 week before installing the membrane.

PART 2 PRODUCTS

2.1 HOT POURED POLYMER MEMBRANE

- A. Characteristics:
 - 1. Single Component Elastomeric Material
 - 2. Applied hot
 - 3. Spreadable to uniform thickness after cooling
 - 4. ASTM C 578
- B. Mechanical Properties:
 - 1. Penetration, Max: 100
 - 2. Pliability, at 10 degrees F: No cracks when bent 180 degrees over a 1 inch mandrel.

2.2 RUBBERIZED ASPHALT MEMBRANE

- A. Characteristics:
 - 1. Laminate Form
 - 2. Heat Resistant
 - 3. Self-adhesive surface protected by special release paper

B. Mechanical Properties:

Property	Method	Value
Thickness, inch min.		0.065
Permeance-Perms, grains/sq ft·hr·inhg	ASTM E 96, Method B	0.10
Tensile Strength, psi	ASTM D 882, (modified for 1 inch opening)	50
Elongation, percent	ASTM D 882, (modified for 1 inch opening)	75
Puncture Resistance (Mesh), lb	ASTM E 154	200
Pliability, at -15 degrees F	ASTM D 146	No cracks in mesh or rubberized asphalt when bent 180 degrees over a 1/4 inch mandrel

2.3 PATCHING CONCRETE

- A. Select from the Performance Data Products Listing (PDPL) maintained by the UDOT Research Division.

2.4 FIBERGLASS MATTING

- A. Weight = 1.5 lbs/yd²

2.5 BINDER

- A. Compatible with the matting material and conforming to the following requirements:

Property	Method	Value
Penetration, 0.1 mm	ASTM D 5	40-82
Softening point, min.	ASTM D 36	155 degrees F
380 degrees F. viscosity, cps	ASTM D 3236	1000 - 1800
Low temperature flexibility, max.	Vermont DOT (modified)	0 degrees F

PART 3 EXECUTION

3.1 PREPARATION

- A. Concrete deck:
 - 1. Sandblast to remove asphalt and all other foreign material from the entire deck, approach slabs and sides of the parapet for a height of 4 inches above the concrete deck.
 - 2. Vacuum or use compressed air to remove all dust and loose material from the deck.
 - 3. Remove all sharp ridges and projections that could puncture the membrane.
 - 4. Patch holes or spalled areas in the concrete deck with patching concrete to provide a flat deck surface.
- B. Asphalt Surface: When membrane will be placed on an asphalt surface, apply a 1/2 inch layer of Hot Mix Asphalt as shown on the plans to provide a flat deck surface.
- C. Joints and Cracks: Bond a 12 inch wide strip of woven fiberglass reinforcing to the deck over cracks and joints greater than 3/16 inch wide using a compatible binder.

3.2 APPLY MEMBRANE

- A. Use either hot poured polymer membrane or rubberized asphalt membrane.
- B. Hot pour polymer membrane: Follow manufacturer's recommendations for application temperatures, equipment, and procedures.
 - 1. Primer: Apply primer according to the instructions of the membrane manufacturer, if required.
 - 2. Application Rate: Apply at a uniform rate to yield a minimum membrane thickness of 3/32 inch.
 - 3. Vertical Surfaces: Apply the membrane on existing vertical surfaces and curb faces to a height 1 inch above that required for the asphalt surfacing overlay without splattering.
 - 4. Defects: Repair membrane that exhibits pin holes surface blisters, crazing or cracking after cooling.
 - 5. Protection: Protect the membrane from damage by using asphalt roofing felt (30 lbs/200 sq ft) when asphalt surfacing is not placed within 4 hours of placing waterproofing membrane. Observe the following characteristics and procedures when using the asphalt roofing felt:
 - a. Cover entire surface and lay dust side up.

- b. Lay parallel to the centerline of the roadway with a minimum overlap of 4 inches between adjoining sections.
 - c. Bond overlap with suitable mastic or cement.
 - d. Place free of wrinkles, bubbles or other defects. Repair any placement defects.
 - 6. Traffic: Allow only necessary rubber tire vehicles on the membrane system.
 - a. Do not allow public traffic.
 - b. Maintain the roofing material in good condition until covered with pavement.
 - 7. Preparation for overlaying: Do not use a tack or prime coat on the top surface of the asphalt rolled roofing.
- C. Rubberized Asphalt Membrane: Follow membrane manufacturer's recommendations for application temperatures, equipment, and procedures.
- 1. Primer: Use primer furnished by the manufacturer of membrane material. Apply primer to all surfaces to be covered by the membrane according to the manufacturer's recommended procedure and application rate.
 - 2. Placement: Overlap prefabricated membrane strips a minimum of 4 inches. Place joints such that a shingling effect will be achieved in which water will drain effectively.
 - 3. Bonding: Use hand rollers or other satisfactory pressure apparatus on the membrane to assure firm and uniform contact with the primed surfaces. If necessary to assure a good seal at joints, an adhesive may be required or use a wide tipped torch to cause tackiness.
 - 4. Placement: Place the membrane on the vertical face of the concrete curb to the height of the finished overlay surfacing.
 - 5. Defects: Protect the entire membrane from developing wrinkles, air bubbles, or other placement defects. Patch any torn or cut areas and narrow overlaps using a satisfactory adhesive and a piece of membrane. Extend the patch at least 4 inches beyond any defect. Bond the patch firmly to the surface.
 - 6. Traffic: Allow only necessary rubber tire vehicles on the membrane. Do not allow public traffic. Maintain the membrane in good condition until covered with pavement.
 - 7. Preparation for Overlaying: If required by the membrane manufacturer, apply a bond coat of an acceptable adhesive to the surface of the membrane.

3.3 ASPHALT SURFACING OVERLAY

- A. Place required surfacing after the membrane has cured according to manufacturer's recommendations. Deposit, spread, and roll asphalt material so the membrane will not be damaged.

END OF SECTION

Change One - August 29, 2002

No changes made

Change Two - December 19, 2002

No changes made

Change Three - February 27, 2003

No changes made

Change Four - April 24, 2003

Revised Article

2.3 A

SECTION 13553

ATMS CONDUIT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Furnish and install conduit for ATMS field elements and communication.

1.2 RELATED SECTIONS

- A. Section 00725, Scope of Work
- B. Section 02061: Select Aggregate
- C. Section 02705: Pavement Cutting
- D. Section 02741: Hot Mix Asphalt (HMA)
- E. Section 02776: Concrete Sidewalk, Median Filler, and Flatwork
- F. Section 02892: Traffic Signal
- G. Section 03575: Flowable Fill
- H. Section 13554: Polymer Concrete Junction Box
- I. Section 13555: ATMS Cabinet

1.3 REFERENCES

- A. ASTM D2241: Standard Specification for Poly-Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series).
- B. American National Standards Institutes (ANSI).
- C. National Electric Code (NEC).
- D. NEC Article 346: Rigid Metal Conduit

- E. NEC Article 347: Rigid Nonmetallic Conduit
- F. National Electrical Manufacturers Association: (NEMA).
- G. NEMA Article TC-2: Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
- H. NEMA Article TC-3: PVC Fittings for Use with Rigid PVC Conduit and Tubing.
- I. Underwriters Laboratories (UL).

PART 2 PRODUCTS

2.1 MATERIALS

- A. Conduit and Fittings:
 - 1. Schedule 40 PVC rated at 194 degrees F, as specified. NEMA TC-2, NEMA TC-3, UL Listed.
 - 2. HDPE (high density polyethylene) SDR11 rated, as specified. ASTM D 2241.
 - 3. Rigid steel as specified. UL-6.
 - 4. Galvanized as specified. ANSI C80.1.
- B. Multi-Conduit
 - 1. New, prefabricated.
 - 2. Minimum of 4 each 1¼ inch conduit.
 - 3. Label: FIBER OPTIC COMMUNICATIONS, permanent 1/2 inch black letters, every 6 ft, on outside of each conduit.
 - 4. Color code each conduit or cell.
- C. Provide all materials used in the installation of conduits, such as bends, adapters, couplings, glue, plugs and fittings, to meet or exceed all of the recommendations of the conduit manufacturer for suitable installation.
- D. Provide special termination kits from the conduit manufacturer for terminating the conduit in vaults and junction boxes. Provide kits that form a watertight seal of conduit to structure wall.
- E. Use complete conduit sections in nominal 20 ft sections; couplings and fittings to provide for watertight integrity.

- F. Use complete conduit rigid bend sections (11 1/4, 22 1/2, 45, 90 degree angles) complete with bell and spigot. Do not field bend conduit.
- G. Provide #14 solid copper conductor pull wire, Type THHN, for each empty conduit or cell.
- H. Provide fiber optic and electrical buried cable marker warning tape that meets the following requirements:
 - 1. Material: Composite reinforced thermoplastic.
 - 2. Tape Color: Orange (communication) or Red (electric).
 - 3. Length: 5 ft minimum.
 - 4. Text: "Caution Buried Communication Cable" or "Caution Buried Electric" (front and back).
 - 5. Text Color: Black.
 - 6. Width: 3 inch minimum (face or diameter).
- I. Provide jacketed #14 THHN solid green locator wire.
- J. Provide locator wire connection device that meets the following requirements:
 - 1. Screw clamp connection type.
 - 2. Suitable for 22 to 8 AWG.
 - 3. Rated 50 amps.
 - 4. Rated 600 V.
 - 5. Provide zinc bichromate plated steel mounting rail for locator wire connection device.
- K. Backfill
 - 1. Flowable Fill: Section 03575.
 - 2. Free Draining Granular Backfill Borrow: Section 02061.
 - 3. Native material: 96 percent compaction.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Plans depict conduit routing in schematic form only. Base final routing on actual field conditions at the time of construction, including Blue Stake markings, to prevent conflicts with existing utilities.
- B. When installing conduit that houses communication cable, do not allow conduit to deflect vertically or horizontally along its length by a ratio greater than 10:1, (e.g. no more than 4 inch deflection per 40 inch in length).

- C. When installing conduit, do not allow the sum total of the vertical and horizontal deflection of conduit between any two junction boxes to exceed 360 degrees.
- D. Do not place conduit directly above parallel utilities.
- E. If the planned location of conduit is parallel to the existing traffic signal or ATMS conduit, locate conduit within 1 ft of existing parallel conduit run.
- F. Install all conduit bends to have a radius that is:
 - 1. Not less than 12 times the inside diameter of the conduit.
 - 2. Not less than the minimum bend radius of the cable installed within, per cable manufacturer's specifications.
- G. Install conduits that cross finished curbs and gutters, sidewalks, concrete flatwork, textured or decorative surfaces by boring, jacking, or drilling. Entirely replace any damaged section at no additional cost to the Department.
- H. Obtain appropriate permits before work commences.

3.2 TRENCH FOR CONDUIT

- A. Paved Surface (asphalt concrete):
 - 1. Prior to any backhoe use, sawcut roadway to roadway base on both sides of trench to provide clean, straight wall for T-patch.
 - 2. Use flowable fill to within 3 1/2 inch-6 inch of the existing roadway surface, depending on the existing pavement thickness.
 - 3. Minimum soil compaction under pavement: 96 percent.
 - 4. Evenly apply tack coat before final backfill.
 - 5. Restoration patch: match the composition, density, and elevation (" 1/4 inch), of the existing surface.
- B. Sidewalk or Decorative Pavement.
 - 1. Use flowable fill to within 3 1/2 inch-6 inch of the existing roadway surface, depending on the existing pavement thickness.
 - 2. Minimum soil compaction under pavement: 96 percent.
 - 3. Restore sidewalk or decorative pavement to original condition or better after work is completed.
- C. Unpaved Surface:
 - 1. Use backfill that matches the composition, density, and elevation (" 0.2 inch), of the existing surface.
 - 2. Dispose of surplus material daily.

- D. Conduit under Railroad Right-of-Way: Refer to Section 00725, Article: Railway Highway Provisions, and appropriate Railroad, such as Union Pacific Railroad, Standard Specifications:
 - 1. Coordinate all work with appropriate Railroad personnel.
 - 2. Complete Railroad Safety Training.
- E. Minimum cover of conduit:
 - 1. Minimum cover in sidewalks, paved ditches, unlined ditches, gutters: 2 ft.
 - 2. Minimum cover in highway right of way under pavement surface: 3 ft.
 - 3. Minimum cover within 20 ft of edge of pavement where signs or delineators are located: 5 ft.
 - 4. Where final landscape above conduit is not finished and has elevation greater than adjacent curb, use top back of curb as base elevation for determining minimum cover.
- F. Warning Tape:
 - 1. Install orange warning tape with black legend CAUTION - BURIED COMMUNICATION CABLE in all trenches containing multi-duct conduit or conduit containing communication cables.
 - 2. Install red warning tape with black legend CAUTION - BURIED ELECTRIC in all other trenches.
 - 3. Not required when flowable fill is directly overlaid with asphalt pavement or PCCP.
 - 4. Not required when boring conduit.
- G. Locator Wire:
 - 1. Install #14 THHN solid green locator wire continuously in 1 inch conduit and bond to grounding rods within each junction box.
 - 2. Mount locator wire connection device to the side wall of each junction box using a mounting rail.
 - 3. Connect the locator wire to the terminal block and connect the terminal block to the ground rod.
 - 4. Weld or clamp locator wire at transition if a sweep is used in place of a junction box at a transition between GRS and PVC. Provide corrosion protection as per NEC Article 346 at location of weld or clamp.

3.3 INSTALL CONDUIT

- A. Place all conduits in the same trench before surfacing.
- B. Above ground use galvanized rigid steel; underground use PVC or HDPE. Apply corrosion protection per NEC Article 346 to any portion of galvanized rigid steel conduit buried in the ground or encased in concrete.

- C. Seal uncapped conduit ends inside junction box with duct seal. Insert seals a minimum of 2 inches inside the conduit.
- D. Install #14 stranded THHN pull wire in all empty conduit including all cells of multi-duct conduit.
 - 1. On each end of conduit install plug with 1/4 inch hole for pull wire.
 - 2. Leave 2 ft of pull wire outside of the plug and fasten securely to plug.
- E. Place all conduit that passes through a structural member in a metallic sleeve.
- F. Secure conduit on structures with standard galvanized iron conduit clamps using at least 5/16 inch diameter concrete expansion anchors at maximum 5 ft spacing.
- G. Use conduit expansion fittings at structure expansion joint crossings.
- H. Install all conduits so the backfill completely surrounds all exterior surfaces of the conduit. Separate multi-duct conduits using a commercially available conduit spacer or approved equivalent.
- I. Install a bushing or adapter at ends of all nonmetallic conduit that contains a conductor per NEC Article 346, to protect the conductor from abrasion. Install rounded bushings on the ends of metal conduits per NEC Article 347.
- J. Fill all new and existing conduit to less than 40 percent as per NEC.
- K. Install bends in the multiconduit to be manufactured sweeps (11 1/4, 22 1/2, 45, 90 degree angle) with conduit compatible bell and spigot ends.
- L. Prior to pouring flowable fill, anchor the conduit in trench, at 16 ft intervals, to maintain the required conduit depth during pour.
- M. Minimum separation between all conduit is 1.5 inch. The separation between individual conduit within a single cluster of multi-duct conduit are permitted to be closer.
- N. Minimum separation between all conduit and the wall of the trench is 1.5 inch.
- O. Place the locator wire conduit on the plane of the uppermost conduit in the trench. The separation between the locator wire conduit and other conduit may be less than 1.5 inch.
- P. In native earth, do not place flowable fill closer than 6 inch to finished grade.
- Q. If flowable fill is used, encapsulate conduit a minimum of 3 inch above the top conduit with flowable fill.

3.4 USE OF OCCUPIED CONDUIT

- A. Maintain the physical condition and functional integrity of all cabling and wiring in existing occupied conduit.
- B. Prior to installing fiber optic cable in an occupied conduit:
 - 1. Remove any existing fiber optic cable/copper wire
 - 2. Re-pull new and existing fiber optic cable/copper wire together
 - 3. Perform all necessary fiber splices, replace any impacted fiber cable spider fan-out kits
 - 4. Perform all additional necessary work needed to restore existing fiber optic system

3.5 REPAIR/RESTORATION

- A. Restore all areas, including landscaping, concrete pavement, asphalt, finished curbs and gutters, box culverts, sewers, underground water mains, sprinkler systems, sidewalks, concrete flatwork, textured or decorative surfaces, that were damaged during conduit and junction box installation.
- B. Coordinate with local utilities for utility repair. Advise the Engineer of all repairs.

END OF SECTION

Change One - August 29, 2002

No changes made

Change Two - December 19, 2002

No changes made

Change Three - February 27, 2003

No changes made

Change Four - April 24, 2003

Revised Articles

1.2C Title Changed

SECTION 13554

POLYMER CONCRETE JUNCTION BOX

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Furnish and install pre-cast polymer concrete junction box, ground rod, and maintenance marker.

1.2 RELATED SECTIONS

- A. Section 02056: Common Fill
- B. Section 02061: Select Aggregate
- C. Section 02842: Delineators
- D. Section 02892: Traffic Signal
- E. Section 03055: Portland Cement Concrete

1.3 REFERENCES

- A. ASTM C 109: Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch or 50 mm cubes).
- B. ASTM C 496: Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
- C. ASTM C 579: Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
- D. ASTM C 580: Standard Test Methods for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
- E. ASTM C 1028: Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull Meter Method.

- F. ASTM D 543: Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents.
- G. ASTM D 570: Standard Test Method for Water Absorption of Plastics.
- H. ASTM D 635: Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastic in a Horizontal Position.
- I. ASTM D 790: Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Insulating Materials.
- J. ASTM G 154: Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials.
- K. ANSI/UL 467: Grounding and Bonding Equipment.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Provide special termination kits from the conduit manufacturer for terminating the conduit in junction boxes. Provide kits that form a watertight seal of conduit to structure wall or grout around the conduit. Finish grout smooth and flush with the interior wall.
- B. Use free draining granular backfill borrow as per Section 02061.
- C. Use granular backfill borrow per Section 02056.
- D. Provide maintenance markers for junction boxes along freeways and expressways.
- E. Provide concrete AA(AE) for concrete collar. Refer to Section 03055.
- F. Provide pre-cast polymer concrete junction boxes per the size and type specified in the plans. Boxes are made from polymer concrete.
- G. Use body, ring, and lid meeting the physical and chemical requirements listed in Table 1:

Table 1

Property	ASTM Test	Value
Compressive Strength	C 109	11,000 psi

Flexural Strength	D 790	7500 psi
Tensile Strength	C 496	1700 psi
Effects of Acids	D 543	Very Resistant
Effects of Alkalies	D 543	Very Resistant

H. Provide all components with ultraviolet inhibitors per ASTM G 154.

I. Provide all components flame-resistant per ASTM D 635.

2.2 JUNCTION BOXES AND LIDS

- A. Provide junction boxes and vaults that resist water absorption in accordance with ASTM D 570.
- B. “Load Rating 3” for Non Wheel Loading Accessible, Behind Sidewalk
 - 1. In area behind sidewalk, provide boxes, rings, and lids that sustain a minimum vertical test load of 12,000 lbs over a 10 inch x 10 inch square.
- C. “Load Rating 2” for Incidental Vehicular Traffic:
 - 1. In area not in traveled way, provide boxes, rings, and lids that sustain a minimum vertical test load of 22,500 lbs over a 10 inch x 20 inch square.
 - 2. Provide concrete collar per Standard Drawing AT-7 for all boxes that may experience incidental traffic.
- D. “Load Rating 1” for Deliberate Vehicular Traffic:
 - 1. In any paved area immediately adjacent to the mainline, such as shoulders, snow storage areas, or vehicle pullout areas, provide boxes, rings, and lids that sustain a minimum vertical test load of 45,000 lbs over a 10 inch x 20 inch square.
- E. Provide a poured-in-place 1 inch thick grout floor, with a 1 inch diameter drain, for all type I-PC, II-PC, and III-PC boxes or a box with a prefabricated floor with a 1 inch drain hole.
- F. Provide lid for all junction boxes as specified by application.
- G. Provide lids with a non-skid surface with minimum coefficient of friction of 0.50, per ASTM C 1028. Coatings will not be approved.

- H. Manufacture lids with the following markings in the logo area, in 1 inch recessed letters:
 - 1. "Traffic Signal" when the junction box contains cables or wires for traffic signal, CCTV, VMS, RWIS, WIM, ramp meter, traffic monitoring, or any other ATMS element.
 - 2. "Electric" when the junction box contains power conductors used for traffic signal, CCTV, VMS, RWIS, WIM, ramp meter, traffic monitoring, or any other ATMS element.
 - 3. "Street Lighting" when the junction box contains street lighting conductors only. Inscribe "High Voltage" below the words "Street Lighting" when the junction box contains voltage above 600 V.
 - 4. "Communication" when the junction box contains multiduct conduit for future use.
 - 5. "Sprinkler Control" when sprinkler control conduit enters the junction box.
- I. Provide lids with recessed access point to allow removal of cover with a hook or lever. Damage to the pulling point in the lid must be repaired.
- J. Provide lids with vandal-resistant stainless steel recessed bolts.

2.3 MAINTENANCE MARKERS

- A. Steel posts: Refer to Section 02842.

2.4 BACKFILL

- A. Compact free draining granular backfill borrow under junction boxes. Refer to Section 02061.
- B. Compact granular backfill borrow around boxes. Refer to Section 02056.

2.5 DUCT SEAL

- A. Waterproof, rodent proof, non-corrosive, non-oxidizing, and non-hardening when subject to temperatures ranging from -13 degrees F to 150 degrees F. Do not use foam sealant.

2.6 GROUND ROD

- A. Copper-coated steel as specified.
- B. ANSI/UL 467.

2.7 GROUND WIRE

- A. Ground Wire: Refer to Section 02892.

PART 3 EXECUTION

3.1 JUNCTION BOX AND EXTENSION

- A. Install per manufacturer's recommendations.
- B. Cast conduit holes in junction box at the time of precasting or drill at the time of placement with no structural damage to the box.
 - 1. Holes drilled in junction box must not be more than 1/4 inch larger than conduit diameter.
 - 2. Seal conduit ends inside all junction boxes with at least 2 inch thick duct caulking after wires are installed.
 - 3. Seal vacant conduit with 2 inch thick duct caulking or a manufactured plug designed for that purpose.
- C. Place the top of the junction box flush with the surrounding grade or set at the planned finished grade.
- D. Hand tamp the granular backfill borrow material around the junction box. Match the top 4 inches to the composition, density, and elevation of the surrounding surface.
- E. Do not install junction boxes inside of railroad right of way.
- F. Field locate junction boxes to avoid steep slopes and low lying locations with poor drainage.
- G. Do not install junction boxes within the traveled way, shoulders, or on approaches to signal poles.
- H. Do not install conduit in corner of junction box, or within 2 inches of corner of junction box. Extend multiduct conduit 6 inches (nominal) beyond the inside wall of the junction box. Extend all other non-multiduct conduit 2 inches minimum to 3 inches maximum beyond the inside wall of the junction box. Refer to Standard Drawing AT-7.
- I. Enter conduit through the sides of the junction box and not from the bottom. Place the conduit at least two inches above the floor.

- J. Orient the recessed access point in a location which provides both leverage and safety.
- K. Saw cut concrete or other improved surfaces that require removal in the sidewalk area. Remove entire section of sidewalk. Replace with in-kind materials to match the existing grade.
- L. Provide 12 inches deep free draining granular backfill borrow directly under junction box.
- M. Install expansion joint material around entire periphery of ring for junction boxes installed in paved surface.

3.2 CONCRETE COLLAR

- A. See Standard Drawing AT-7.
- B. Concrete: AA(AE). Refer to Section 03055.
- C. Do not install concrete collar for junction boxes in paved surface. Install concrete collars in areas of incidental traffic.

3.3 GROUND ROD

- A. Install ground rod to extend maximum 2 inches above box floor.
- B. Attach ground wire or locator wire with clamps.

3.4 RESTORATION

- A. Restore all areas damaged during the installation of the junction boxes.

END OF SECTION

Change One - August 29, 2002
No changes made

Change Two - December 19, 2002
No changes made

Change Three - February 27, 2003
No changes made

Change Four - April 24, 2003
Revised Articles

- 1.1 A**
- 1.3 C and D added**
- 2.1 A**
- 2.1 F**
- 2.2 D 1**
- 2.2 D 2 deleted**
- 2.2 E**
- 2.2 H**
- 2.2 H 2**
- 2.2 H 3 deleted and renumbered**
- 3.1 B 3 added**
- 3.1 I**